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Works Visits

The object of throwing open works to visitors is a good form of publicity. To be successful it needs very careful preparation. A test should be made of the time to make the tour and consideration should be given to the major interests of the visitors. If the inspection is made by a cross-section of the public—such as on "open days"— then an effort should be made to include the most spectacular of the processes used, and the control imposed to ensure high quality. There should be a realization that to the layman the processes are complicated and supposing that, by the display of placards, they can be clarified, so much the better. If, at the conclusion of the visit, a film-show can be given, it adds much interest. The hosts should remember that a tour of a works is as tiring as shopping in Oxford Street, and a self-service meal, involving queueing, is undesirable, though it may be necessary.

The description given by the guides should be rehearsed beforehand, and conversation with a pilot's nearest neighbour should be restricted to the minimum required by common courtesy. Some large firms employ professional guides, and our experience of these is that they are excellent, and better than the departmental managers, who say too much about their own section and too little about others. Moreover, technicians usually find the questions put by the layman distinctly boring. If the publicity department can prepare route charts, with the various halts indicated, and supplement these by information as to what is being done—including production figures—and what can be seen, much will result to enhance the value of the visit. When technical societies are invited, the technique used should be varied. The timetable should allow a maximum stay in the departments which, in particular, interest the visitor. The technical staff should then be used as guides, for they will learn much from the visitors. The parties should be kept as small as possible and we favour limiting the total number to ensure this, even though it involves the sending of a second invitation for a later date.

Few people have visited more works than ourselves, and on some occasions we have acquired more fatigue than information, through being a member of a large group. Yet, when the same works has been visited alone or with one or two others, the information gained and exchanged has been of outstanding interest. There is one thing of which we are reasonably sure, and that is that the odd competitor or so present will be quite unable to assimilate sufficient detailed technical information during a visit to create a real risk, though he may gain a little on the commercial side, by learning the names of customers. Most larger works have publicity managers and they should be brought into the picture. They may advise the giving of some appropriate little souvenir, as this can form a permanent piece of advertisement for the hosts. Properly handled, these works visits can be of great publicity value—an aspect easily deducible from the fact that some of our larger concerns do include professional guides on the staff.

F

Steel Industry Fuel Supplies

The March performance of the steel industry is indeed gratifying. An ingot output at the rate of 16,648,000 tons per annum is the best since April, 1951, and the March production of pig-iron was the best ever recorded. These achievements are all the more remarkable when it is recalled that the industry is handicapped by the shortage of scrap and coke. Despite the most energetic efforts, it has proved impossible to arrest the shrinkage in scrap supplies and it is for that reason that the British Iron and Steel Federation has emphasized again that further increases in pig-iron production are essential if the output of steel is to equal last year's figures.

The industry is gravely concerned about its coke supplies. According to official statements, as long ago as 1948 the supply of purchased coke from the N.C.B. and other ovens averaged 76,000 to 77,000 tons a week, and the steel industry's development plan was based on the maintenance of deliveries on that scale. Since that date the N.C.B. coke output has increased, but, it appears, nothing extra has gone to the blast furnaces. On the contrary, the iron trade asserts that it is now receiving 6,000 tons less than its quota in 1948 and that coke stocks at the blast furnaces are now down to four days' supply.

Latest Foundry Statistics

According to the February issue of the Statistical Bulletin of the British Iron and Steel Federation, employment in ironfoundries rose from an average weekly figure on December 8, 1951, of 152,680 to 153,728 on January 5, 1952. Of the 1,048 increase all but 16 were males. Over a year the increase has been of the order of 3,700. The average weekly production of liquid steel for the making of steel castings was 10,200 tons in January, as against 9,500 tons in December and 8,500 tons in January, 1951.

According to the British Bureau of Non-Ferrous Metal Statistics, the output of copper-base castings during February was 5,385 tons. Production is running higher than last year.

Copper Scrap Costs More

The Minister of Supply, Mr. Duncan Sandys, has made an Order adjusting the price of copper and copper alloy secondary and scrap metals. This follows the recent announcement by the Ministry of Materials of an increase of £4 a ton in its selling price for virgin copper.

The Order—the Copper, Zinc, etc., Prices Order, 1952, SI 1952, No. 729—increases the maximum controlled prices of secondary unwrought copper by £4 a ton, copper scrap, gilding metal, and gun metal by £3 a ton, and cupro-nickel and brass by £2 a ton.

THURSDAY, OCTOBER 9, is the date fixed for the convention and dinner of the Joint Iron Council.

WESTERN METALLURGICAL INDUSTRIES, LIMITED, a subsidiary company set up by George Cohen, Sons & Company, Limited, with headquarters at Swansea, hopes to recover 5,000 tons of iron a year, in addition to lead and zinc, from dumps that consist of the residue of old spelter works, and lie between Morriston and Landore. There are 1,500,000 tons of residue to be treated, and the company hopes to have work for 150 to 200 men for the next 20 years. The Ministry of Supply has approved the venture, and a start should be made within the next 18 months.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

MAGNESIUM ADVISORY COMMITTEE

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—My attention has been drawn to a statement* issued on behalf of Essex Aero, Limited, regarding participation in the Magnesium Advisory Committee.

The formation of this representative Committee has been welcomed by the Ministry of Supply as affording a useful means of consultation between the industry and the Ministry on matters of mutual interest in the magnesium field. It is not concerned with sale prices and in no sense affects the independence of individual members.

Essex Aero, Limited, refused an invitation to co-operate, as they were fully entitled so to do. Their abstention is regretted and the invitation to join the new committee remains open to them at any time they care to accept it.—Yours, etc.,

E. PLAYER, chairman,
Magnesium Advisory Committee.

* See page 430 of this issue.—EDITOR.

Hold-up of Cast-iron Water Pipes

Delivery of a special type of 9-in. cast-iron water main—the kind urgently wanted by Campbeltown Town Council for their new municipal water scheme—may take from two to three years. Major Duncan McCallum, M.P. for Argyll, has been given this information by Mr. T. G. Galbraith, M.P., Joint Under-Secretary for Scotland.

Major McCallum wrote to the Ministry of Works on representations which he had received from Campbeltown Town Council, pointing out the difficulty which the council was having in getting these pipes for the water scheme, which was supplying at increased pressure certain parts of the town served by the old system. It was for this purpose that the 9-in. pipes were necessary. Mr. Galbraith states that although for some years orders of cast-iron pipes have been restricted to those required for urgent schemes manufacturers now have more orders than they can cope with. The Campbeltown project was commendable, but not more urgent than many other schemes throughout Scotland and he could hold out no hope of advancing the delivery date already given by the manufacturers.

International Productivity Symposium

A symposium of the foundry industry is to be held later this year (probably in Holland) under the auspices of the Organization for European Economic Co-operation. Its main object will be for members of national productivity teams to meet and discuss problems of foundry productivity, and the benefits they have secured following their visits to the United States. Others interested in the industry may also participate in the symposium. Further information may be obtained from Mr. C. P. Bath, Ministry of Supply, Engineering Industries Division, Shell Mex House, Strand, London, W.C.2 (Tel. No.: GERrard 6933. Extn. 281) and it is hoped to print further details in the JOURNAL as these become available.

MR. FREDERICK H. JOHNSON, for some years past a local director of Thomas Smith & Sons (Rodley), Limited, crane and excavator makers, has been appointed a full director of the company, which is one of the Thos. W. Ward group.

Recent Development of Cupola Design with Special Reference to Hot-blast

By Dr. Ing. Fritz Schulte

After a short survey of performance figures, recently published, for some 500 German cupolas, the importance is stressed of maintaining uniform melting conditions by keeping a constant "specific airflow" in the cupola shaft. This aim can only be achieved if lining wear be kept to a minimum. Artificial cooling of the lining seems to be the only way to this end. Special reference is made to an American cupola, described by Kopecki, and to the Philipon furnace, which both have a "protective coke layer in front of the water-cooled lining." The special importance of water-cooling for hot-blast cupolas is emphasized. The effect of blast preheating on the theoretical combustion temperature and coke consumption is shown in a diagram. Various types of recuperators are then shown and the special advantage of combining a single, water-cooled cupola with the recuperator is explained. Tentatively the suggestion is made that the cupola-shaft could be shortened by perhaps one-third, if hot-blast be used. The effects of oxygen addition are briefly mentioned. It appears that oxygen addition will not bring an appreciable coke saving, although it has quite similar effects to blast preheating in all other respects. Superheating and adjustment of the composition of cupola-iron in an electrically-heated well or forehearth is also mentioned.

In the course of time, design and method of operation of the cupola has undergone little or no alteration, because it is one of the cheapest melting units and is based on a sound and simple principle. In short, a cupola could be described as a counter-flow heat-exchanger, in which charge and fuel are travelling down against the rising current of products of the combustion, taking place in front of the tuyeres near the bottom end of the shaft. The metal charge and fuel are in this way preheated, before they reach the melting zone and the zone of fuel combustion, whereas the gaseous combustion products are cooled to fairly low temperatures, before they leave the furnace. Very good use is therefore made of the sensible heat of the gaseous combustion products and no improvement seems possible on this fundamental principle.

On closer investigation, however, things are not quite so simple. Apart from coke combustion and heat transfer from gas to load, two chemical reactions take place between the gas stream and the descending coke. One of them produces and the other consumes heat. It is well-known that of these two the reaction $CO_2 + C \rightarrow 2CO$ minus heat is the more important. The heat consumption of this reaction is so great that it has considerable influence on the efficiency of the cupola. Unfortunately the reverse reaction. $2CO \rightarrow CO_2 + C$ plus heat, which is to be expected in the cooler parts of the furnace, proceeds only very slowly and in the short time available at suitable temperatures it cannot compensate to any appreciable extent for the heat loss by CO formation in the hotter parts of the furnace.

Similarity to Blast Furnace

Thus, against general wish, the cupola is not only a melting furnace with very efficient preheater for fuel and metal charge, but also, to some extent, a gas-producer.

There is a striking similarity in fundamental principle between the cupola and the blast-furnace, which might, logically, be considered as its bigger brother. The only essential difference between the two is in the excess oxygen, brought into the blast-furnace by the iron ore, which has, of course, an important effect both on coke consumption and gas production.

It makes the blast-furnace quite unavoidably a large-scale gas-producer and, in fact, there are cases where a blast-furnace is primarily run as a gas-producer and the pig-iron only forms an important by-product.

All the other differences between blast-furnace and cupola relate rather more to size and design detail than to principle. This statement seems worthwhile, if one considers that only a few years ago it was still possible that well-known metallurgists tried to prove that the application of hot blast in the cupola could not bring any practical advantage, although, at the same time, the advantages of hot blast for blast-furnaces were quite well known and generally utilized.

A comparison with the blast-furnace, which obviously has developed out of the same idea as the cupola, is also interesting for other reasons. For instance, it is quite usual to empty a cupola every night, cool it down quickly, and patch the lining. With blast-furnaces, continuous runs for a number of years are the normal procedure. In times of unemployment, blast-furnaces have been damped down for half a year and restarted, without emptying them. Why should such methods not be possible on a cupola? Air temperatures of approximately 800 deg. C. are nothing unusual in blast-furnaces, but with cupolas it is so far considered inadvisable to work with blast temperatures of more than about 500 deg. C. The above gives a quick comparison between the cupola and the blast-furnace.

* Paper read before the Birmingham branch of the Institute of British Foundrymen with Mr. T. R. Twigger in the Chair.

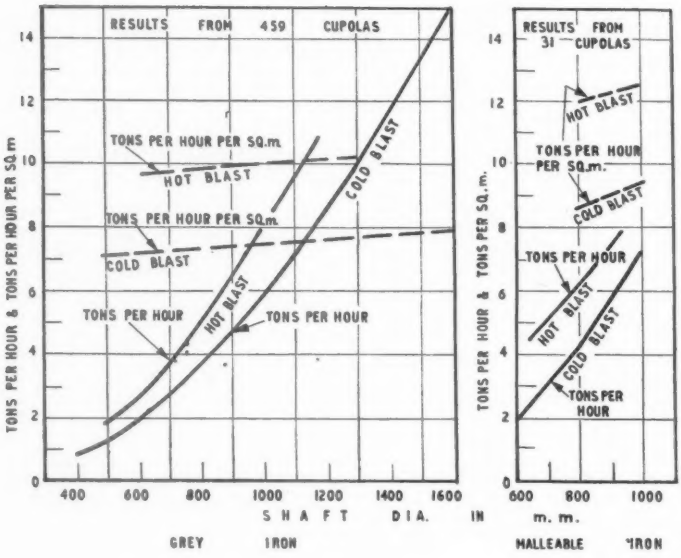


FIG. 1.—*Hourly Output of Cupolas.* [*According to K. Roesch and K. Gutmann*

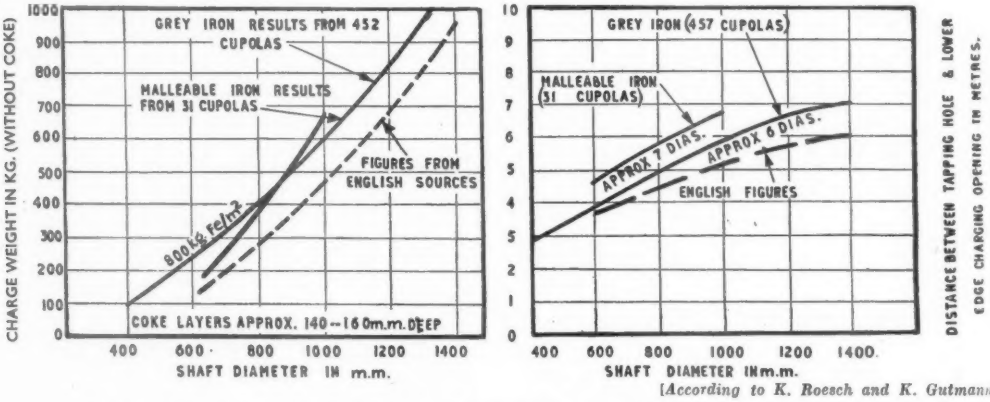
Cupola Performance Figures

A short *résumé* of a survey recently made by Roesch and Gutmann[1] will help to show what the old established performance figures are on which new development is trying to improve. Fig. 1 shows the relation between shaft diameter and output in tons per hour both for grey iron and malleable iron. The output curves roughly follow parabolas, *i.e.*, the output per unit area of free shaft cross-section is almost the same for various diameters. A few values are available for hot blast of about 400 to 500 deg. C., which indicate a considerably higher output for both materials.

In Fig. 2, iron charge weights are plotted against furnace diameter. This graph shows that most melters agree on a constant charge weight of approximately 0.4 ton per sq. m. free shaft area. The corresponding coke charges amount to layers of about 5 to 7 in. deep. The loading height in the shaft is approximately six shaft diameters for grey iron and seven shaft diameters for malleable iron.

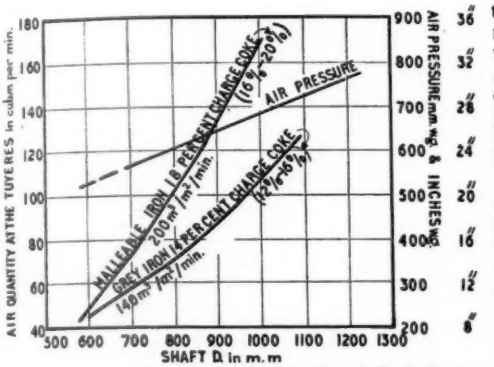
Air flows in cub. m. per min. and air pressures in inches water gauge are shown in Fig. 3. The information given by Roesch and Gutmann is the result of a systematic evaluation of present practice in German grey iron and malleable iron foundries and describes the average situation for some 450 grey iron and 31 malleable iron cupolas. The Authors also compared the results of their investigation with English and American publications and found them generally in good agreement with these.

The relations between furnace diameter, output, air consumption, air pressure, charge weight, etc., can therefore be considered as a fairly representative of present-day experience. It can be assumed that the relations, shown in these diagrams, are optimum conditions, from which deviations will only be permissible after careful consideration. The founder's first concern must, therefore, be to find means to ensure that optimum working conditions, once established, are maintained throughout the melting period and from day to day.


GREY IRON RESULTS FROM 452 CUPOLAS
MALLEABLE IRON RESULTS FROM 31 CUPOLAS
FIGURES FROM ENGLISH SOURCES
800 kg/m²
COKE LAYERS APPROX. 140–160 m.m. DEEP
CHARGE WEIGHT IN KG. (WITHOUT COKE)
SHAFT DIAMETER IN m.m.
GREY IRON (457 CUPOLAS)
MALLEABLE IRON (31 CUPOLAS)
APPROX 7 DIAS.
APPROX 6 DIAS.
ENGLISH FIGURES
DISTANCE BETWEEN TAPPING HOLE & LOWER EDGE CHARGING OPENING IN METRES.
SHAFT DIAMETER IN m.m.

[*According to K. Roesch and K. Gutmann*

FIG. 2.—(*left*) *Relation between Cupola Charge Weight and Shaft Diameter;* (*right*) *Relation between Shaft Depth and Shaft Diameter.*


AIR QUANTITY AT THE TUYERES in cubm per min.
AIR PRESSURE mm. wg & INCHES wg
SHAFT D. in m.m
AIR PRESSURE
MALLEABLE IRON 18 PER CENT CHARGE COKE (16% to 20%)
200 m³/m²/min.
GREY IRON 14 PER CENT CHARGE COKE (12% to 16%)
140 m³/sq.ft./min.

[According to K. Roesch and K. Gutmann

FIG. 3.—*Relation between Air Quantity, Pressure and Cupola-shaft Diameter, using 8 cub. m. Air per kg. Coke, with 85 per cent. C.*

It should be general practice to weigh all the materials charged into the cupola. That is actually done with the solid charges, but the air is normally measured by volume, although the errors are well-known, which can be introduced by variations of pressure and temperature. Instruments, compensating for pressure and temperature variations, are available, and should certainly pay for themselves in a reasonable time by economies. The main obstacle against their introduction is probably more in the difficulty of finding suitable personnel to keep such instruments in working order than in their initial cost.

Fig. 4 shows that the melting speed is directly proportional to air flow and that the highest metal temperature is obtained under certain conditions only. This should sufficiently stress the importance of correct measurement of blast input. The question of humidity in the air blast has also been discussed, apparently without reaching any final conclusion. Assuming that the relative humidity of air at 15 deg. C. varies from 20 to 80 per cent., the quantity of water brought in by the air would vary from about 6 to 27 lb. per ton of iron. As this water reacts with carbon to form CO and H_2, 5 to 26 lb. of coke per ton of iron can be consumed by this reaction, *i.e.*, between 0.2 and 1 per cent. of the charge weight.

Equipment for drying the large quantities of air required by a cupola is rather expensive in initial cost, and the expense may not be justified in comparison with the coke saving which might be achieved. Some benefit may, of course, be obtained for the metallurgical quality of the iron, if the humidity of the air blast is kept to a low and constant value, but, so far, air-drying equipment seems to be in use only on a few American cupolas.

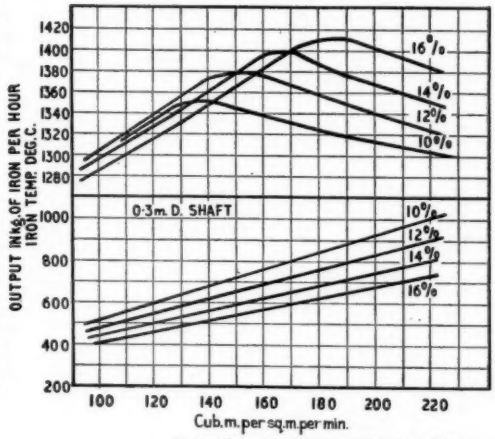
Lining Profile

A matter of rather greater practical importance is the problem of maintaining a given furnace profile throughout the melting period. In Fig. 4 the blast input is plotted in cub. m. per sq. m. per min. This means that it is not sufficient to work with constant coke charges and a constant flow of air in cub. m. per hr; if the shaft diameter increases by erosion of the lining, the specific air flow per cub. m. per sq. m. per min. will be reduced, unless compensation is made by increasing the hourly air quantity.

The alteration of the free area in a cupola shaft can be quite considerable in the course of a working day. For instance, with a cupola of 2 ft. inside diameter at the beginning of the melting period, the area will increase by 50 per cent., if the inside diameter grows to 2 ft. 6 in. The specific air flow would then fall to 66 per cent. of the original value. It is difficult to ascertain how the effective shaft area alters during a melting period, and therefore almost impossible to make the appropriate adjustment to the air flow. Anyway, such an adjustment might not be desirable, as it would increase the melting speed.

Apart from this, the normal erosion of the lining requires expensive repair work at the end of each melting day. A number of successful attempts have been made to overcome both the alteration of the effective shaft area and to reduce maintenance work by suitable cooling of the lining. The work done by Renshaw and Sargood[2] is well known in this country and need not be described here. E. S. Kopecki[3] has reported on a very interesting design in the *Iron Age*. His report deals with a fairly large cupola (5 ft. inside diameter, 12 tons per hr. output), which very closely resembles a small blast furnace.

This furnace is specially designed (Fig. 5) to give long runs without lining repair. Kopecki reported in 1949 that continuous runs of some 10 days have so far been obtained with negligible lining wear, and that the ultimate aim is to keep the cupola in operation for about half a year without



[According to Piwowarsky and Krämer

FIG. 4.—*Influence of Air-flow on Iron Temperature and Output with Various Coke Charges.*

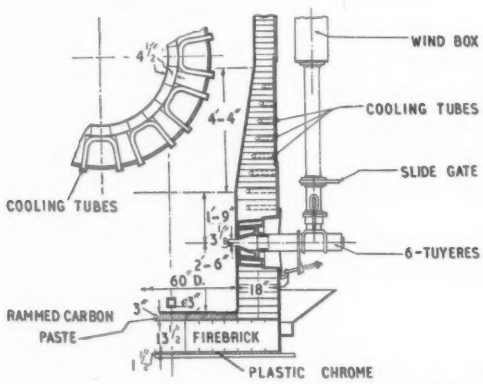


FIG. 5.—*Water-cooled Cupola for Duplexing Plant.*
Ratio $\frac{\text{Bosh area}}{\text{Tuyere area}} = \frac{61.}{1}$ *Air quantity = 10,500 cub. ft. per min. Air pressure, 55 to 68 in. w.g.*

interruption. Whether that has meanwhile been achieved is not known to the present Author. Apart from a water-cooled lining, this cupola has two unusual features, helping to achieve a long lining life. These are (*a*) a fixed bottom, covered with rammed carbon paste and a tapping hole which is positioned in such a way that an iron sump of about 3 in. depth is always left in the furnace, thus protecting the bottom against slag attack; and (*b*) the use of very narrow, water-cooled tuyeres and an unusually-high blast pressure.

This latter feature is specially interesting. Whilst normally the free area of the tuyeres amounts to about one-fifth to one-sixth of the shaft area, they total only one-sixtieth in this case. The effect is that the blast enters the furnace with about ten times the normal speed and the combustion area is pushed further away from the furnace wall towards the centre of the shaft. The highest temperature is therefore developed at some distance from the wall, colder coke serving as a buffer zone between the hottest combustion zone and the lining.

Originally the water-cooled tuyeres were protruding a few inches beyond the inner wall face, but it was found that they extracted too much heat from the iron and they are now flush with the wall. This cupola is melting 24 hours a day, providing iron for duplexing in an open-hearth furnace. Its duty is therefore rather different from that of ordinary foundry cupolas and not all the design features may be applicable to cupolas under more normal foundry duty. Nevertheless, it is a very interesting design and may give some stimulation for the further development of cupolas, especially those operated with hot blast or oxygen addition, in which lining life becomes a limitation to blast temperature or oxygen content.

Doat Cupola

On the Continent, a cupola with very similar design principles has been invented by Philipon and developed by Doat. This cupola also works with a fixed bottom, water-cooled tuyeres and a thin, water-cooled lining. According to Driscoll[4], it is run 16 hours a day for five days a week and emptied only at weekends. With other words, it is damped down over night like a blast-furnace in times of unemployment.

In this case, the water-cooled tuyeres extend about 10 in. beyond the lining, again leaving a wall of comparatively cool coke between the combustion zone and the furnace lining. Apparently no difficulty has been encountered from the cooling effect of the tuyeres, or else it may be minimized, by the effect of the hot blast. This furnace is working with blast temperatures of about 550 deg C. and is metallurgically quite interesting, as it reduces a considerable amount of silicon from the slag.

Both, the Kopecki and the Philipon[5] furnace achieve very long lining life by artificial cooling of the lining and by using a layer of coke as heat-screen in front of the refractory lining. As this coke layer is continuously replaced by the new charges, it can be considered as a "self-repairing lining." Unfortunately, neither of these publications give a very clear idea as to the heat loss, caused by water-cooling.

Renshaw, describing experiments with water-cooled segments in a cupola with 37 in. inside diameter, widened out to 56 in. at the tuyere level, mentions a temperature loss in the iron of about 20 deg. C. by the cooling effect. He also gives a water consumption of 2,500 gal. per hr. with 20 deg. C. temperature rise in the water. From this the heat loss of the furnace can be calculated as 226,000 Kcal per hr. or 50,000 Kcal per sq. m. of cooled area = 58 kw.-h. per sq. m. h. This applies to a very thin lining, probably about ½ to 1 in. thick.

Heat Lost to Cooling Water

O. Mattern[6] quotes some figures for heat losses from cupolas with air or water cooling for various lining thicknesses (Fig. 6.). For an inside temperature of 1,400 deg. C. he calculates, that a cupola with 800 mm. (32 in.) inside diameter would lose enough heat to increase the coke consumption by about 0.15 per cent. of the iron output with a 3-in. lining and by about 0.6 per cent. with a ½-in. lining. His figures are admittedly based on calculation, not on experiment and therefore contain some considerable uncertainty. Assuming, that the cooled part of the shaft was about 5 ft. high, the heat-loss figure would amount to approximately 8,600 Kcal. per sq. m. or 10 kw. per sq. m. for 3-in. lining and 35,000 Kcal per sq. m. or about 40 kw. per sq. m. for a ½-in. lining.

A more reliable appreciation could probably be obtained from a high-frequency steel-melting furnace. On a furnace with approximately 3-in. lining, 20 in. inside diameter and 25 in. height a heat loss of about 33 kw per sq. m. through the

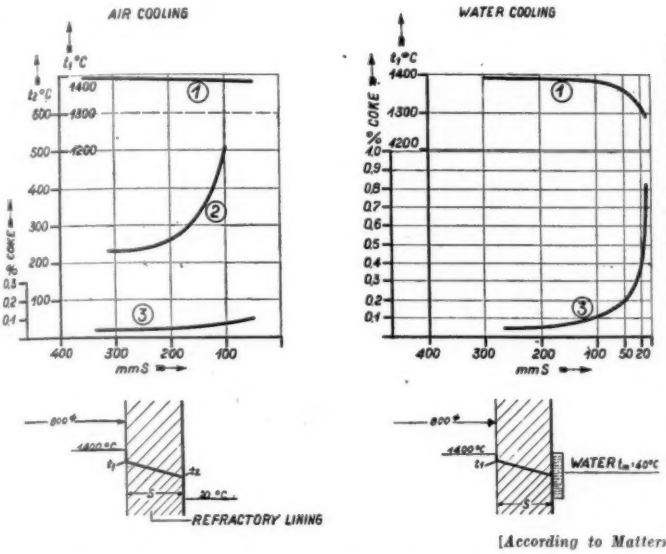


FIG. 6.—*Diagram of Temperature within the Cupola Lining with Air-cooling and with Water-cooling.*

lining was observed with an inside temperature of 1,550 deg. C.[7]. This figure is about three times as high as that calculated by Mattern. It seems therefore possible, that the coke consumption, caused by cooling, might be as high as 0.5 per cent. of the metal output, *i.e.*, 11 lb. of coke per ton of iron. In addition to this there is the cost for cooling water, which can however be kept very small, if the water be recirculated. For the cupola described by Mattern, about 1,200 gal. of water would be required per hour with a 3-in. lining. This is allowing a temperature rise of 20 deg. C. in the water. If the water is recirculated and cooled by evaporation, only about 50 gal. would be required per hour.

It is quite likely, that a considerable saving results from efficient cooling of a relatively thin refractory lining in spite of the slightly increased coke consumption and the expense for cooling water. This saving could be traced back to: less consumption of patching material, less labour, less waste of bed coke.

Both in the example given by Mattern and in the high-frequency furnace, the full furnace temperature was existing right up to the hot face of the refractory lining. With an arrangement as in the Kopecki or the Philipon furnace, a considerable temperature drop can be expected through the protecting coke layer in front of the refractory, which therefore will remain cooler and give a lowered heat loss. With very small cupolas rather heavy heat losses might be caused by artificial cooling, on account of the comparatively unfavourable ratio of wall area to free shaft area.

Thin Linings

As a very thin lining can only be maintained by cooling, it is, of course, necessary to provide a safe supply of cooling-water and to take certain precautions to prevent the formation of high-pressure steam in the cooling system. This, however, is no real difficulty and the problem has been solved in practice with high-frequency furnaces.

The problem of a permanently-cooled cupola lining is dealt with in so much detail, because it seems to be of general interest, although it is obviously of special importance, if melting is carried out with hot blast or oxygen addition.

A certain improvement over present melting conditions will be obtained by the use of thin, cooled linings, as they make possible the keeping of the furnace diameter practically constant over the melting period and of working continuously with a favourable specific blast flow. The fact, that hardly any lining material is slagged, has an important metallurgical effect. Slag composition and quantity then depend almost completely on the fluxing additions charged into the furnace. Much greater care is necessary in this respect. On the other hand, much greater freedom is obtained for deliberate alteration of slag composition.

Preheated Air

Further improvement of furnace performance can be obtained by the use of preheated air. Frauenknecht[8] has tried to preheat air and at the same time avoid heat losses by CO formation, by withdrawing the combustion products from the cupola shaft a short distance above the tuyeres. Fully to achieve his aim, he would have had to do that exactly at the place where the combustion was complete and CO formation had not yet started. For practical purposes that is hardly possible. The gas, withdrawn at such a low level, has of course a very high temperature, as it has not yet been cooled to any great extent by heat exchange with the cold charge nor by the reduction of CO_2 to CO. Together with the undesirable CO formation, the very desirable preheating of the charge is avoided by this system. An attempt was made to use the rather great amount of sensible heat in the gas for preheating the air blast. However, a comparison of his recuperators with those of more recent hot-blast systems makes it obvious that the surface area available for heat exchange was very small in his design. It can be assumed that that was the reason why it was not introduced into practice.

Preheating the air has two distinct effects:—It introduces a certain amount of heat into the furnace, which then need not be generated by coke

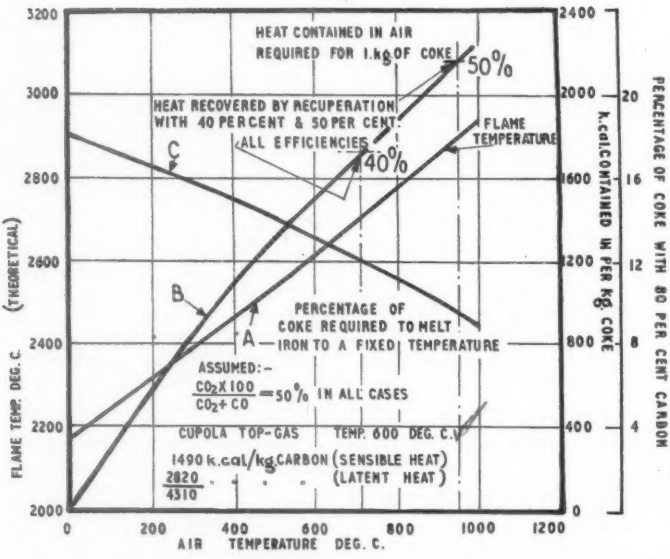


FIG. 7.—*Effect of Air Temperature on Theoretical Flame Temperature and Coke Consumption.*

combustion. For a given requirement of useful heat, less coke need be burnt and less waste gas will be produced, therefore less heat is lost in the waste gas. Furthermore, a quicker, more concentrated combustion is obtained, with locally higher temperatures.

Curve A of Fig. 7 shows how the theoretical flame temperature for the combustion of carbon to CO_2 raises with an increasing amount of preheat of the combustion air.

In the neighbourhood of the tuyeres, complete combustion to CO_2 can be expected, and, although the theoretical flame temperatures will never quite be reached, they give at least some rough idea, as to what effect air preheating has on the temperature of the hottest spot in the furnace. The metal temperature will have some approximate relation to the theoretical flame temperature, as long as the weight ratio of coke to iron is kept the same. Curve B of Fig. 7 shows how much sensible heat is contained in the air required for the combustion of 1 kg. of C., based on the assumption that the normal amount of CO formation which in a cold-blast cupola leads to a combustion ratio

$$\frac{CO_2}{CO_2 + CO} 100 = \text{approx. 50 per cent.},$$

will also be obtained with preheated air.

This is possibly not quite correct. It is known, that for a given coke/iron ratio, higher air temperature results in a higher CO content in the cupola gas. However, with a smaller coke/iron ratio, gas composition comes back to normal, as was illustrated by Bader. (Fig. 8.)

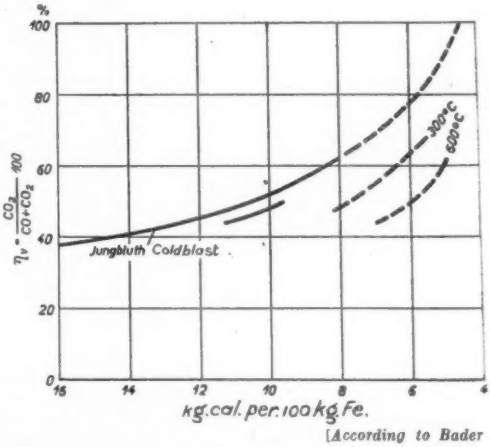
The heat available per kg. of C. for heating purposes is therefore:

heat of combustion ..	8,080 Kcal. per kg.
minus waste-gas heat (600 deg. C.) ..	4,310 Kcal. per kg.
	3,770 Kcal. per kg.

plus the varying amounts of heat, brought in by the heat content of the preheated air.

If, with hot blast, the same coke to iron ratio is maintained as with cold blast, the result will be higher iron temperatures with a slightly faster melting rate. On the other hand, if the coke charges are suitably reduced, the iron temperature can be kept the same as with cold blast, and a corresponding higher melting rate will result, roughly inversely proportional to the coke charge.

Curve C of Fig. 7 shows approximately to what extent the coke charge per 100 kg. of iron could be reduced, with rising air-temperatures up to 1,000 deg. C., when melting to always the same metal temperature. The normal working practice is between these two extremes: The coke charges are reduced only to such an extent that metal temperatures some 50 deg. C. higher than with cold blast are obtained. For this compromise condition, a coke saving of approximately 30 per cent. is quoted for 450 to 500 deg. C. blast temperature. Accordingly, the iron output of the cupola is



[According to Bader

FIG. 8.—*Relation between Coke : Iron-ratio and N_e, with Hot-blast Melting.*

increased by up to 30 to 50 per cent. of the output with cold blast, as, with constant air supply, the furnace will burn an approximately constant coke quantity per hour.

By Curve B (Fig. 7) an indication is given as to what blast temperature could be obtained from the heat contained in the cupola gas. This temperature obviously depends on the overall efficiency of the whole preheating system, consisting of gas take-off pipeline, combustion chamber, recuperator, and hot-blast pipeline. With 40 per cent. efficiency, a maximum blast temperature of about 700 deg. might be obtained; with 50 per cent. efficiency it could be in the region of 900 deg. C.

Limiting Factors

For the practical limitation of air temperature some other points have to be considered, such as:

(*a*) *Lining Life.*—This would probably not be a serious limitation to blast temperature if adequate cooling of the lining be provided, preferably with a protective coke layer in front of the refractory.

(*b*) *Iron Composition.*—Various investigators have observed that with high blast temperatures a considerable amount of silicon is reduced out of the slag when melting, as is normal, on an acid lining. This seems to put the limit for the blast temperature to about 500 deg. C. or only little higher for the melting of malleable iron, in which the silicon content must not increase to more than 0.5 to 1 per cent. For cast iron containing higher percentages of silicon, a higher blast temperature may be permissible. Again, melting iron for duplexing in an acid converter, a silicon content up to, say, 2 per cent. is desirable and a higher blast temperature might be favourable, as less ferro-silicon will be consumed, due to silicon reduction from the slag. The question of silicon reduction will not arise when a basic lining is used. In this case, however, a greater carbon pick-up can be expected, which may or may not be desirable.[9]

(*c*) *Recuperator Life.*—As heat always flows from regions of higher temperature to those of lower temperature, the recuperator walls must necessarily assume a temperature between the temperatures of the blast and the burnt cupola gases providing the heat. The life of the recuperator elements will obviously depend on the maximum temperature to which the metal walls are heated, and on the material from which they are made. It depends to quite an extent on the recuperator design whether the metal temperature will be nearer to the blast or the gas temperature.

Fig. 9 shows the two main flow-patterns normally utilized in heat-exchangers. With parallel flow of gas and air, the coldest air enters at the point where also the hottest gas enters. At the exit end the gas temperature is not much higher than the blast temperature and the recuperator wall-temperature can only vary within fairly narrow limits. By arranging for a larger surface area and higher flow speed on the blast side, the wall temperature can be kept nearer to the blast temperature than to that of the heating gas, with the effect that even the hottest part of the recuperator cannot get much hotter than the final blast temperature. Using counterflow, a much higher temperature head is available between heating gas and the blast at the hot end of the recuperator, and much higher wall temperatures are therefore possible. There is, therefore, a greater danger of overheating the hot end of the recuperator.

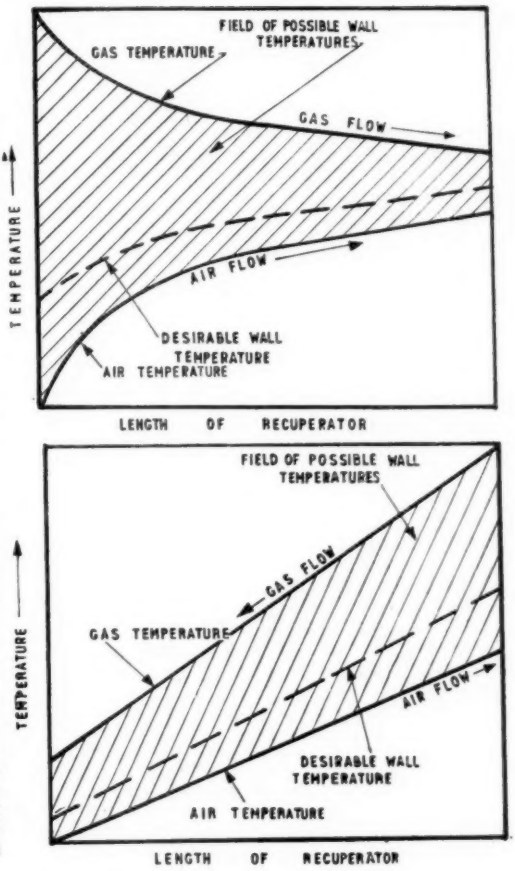


FIG. 9.—(*top*) *Parallel Flow and* (*bottom*) *Counter Flow in a Recuperator.*

Counterflow has, however, the advantage that a higher efficiency is obtainable, as heat can be extracted from the gas stream down to a much lower temperature than in parallel flow. It is quite possible to run recuperators with wall temperatures up to 1,000 or 1,050 deg. C., but this requires heat-resisting alloys carrying high chromium and possibly nickel content, at least for the hot end of the recuperator. Temperatures up to 500 to 600 deg. C. can be dealt with, using cast iron with only small additions of chromium and/or aluminium, which is very much cheaper.

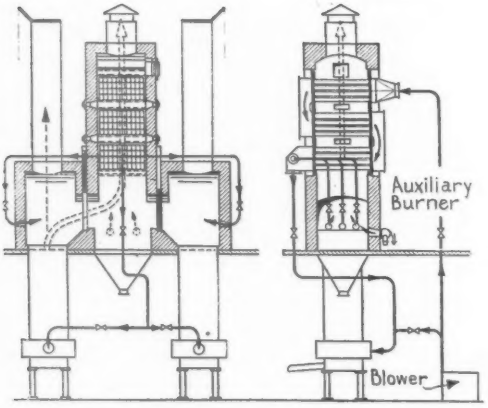


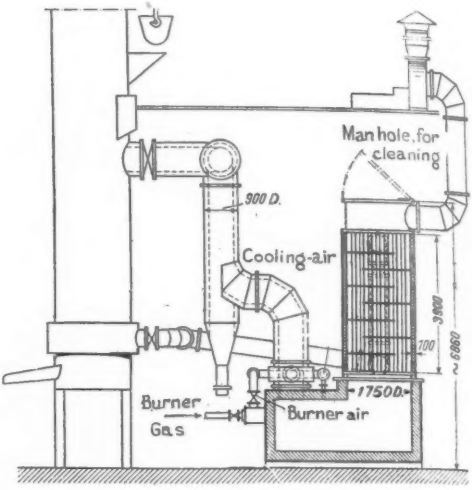
FIG. 10.—*Schematic View of a Hot-blast Cupola (with an Indication of the Air-flow Direction).*

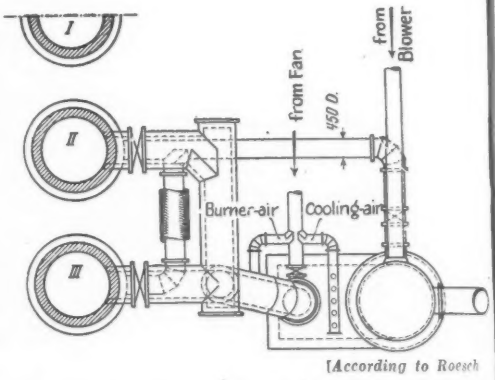
There is, therefore, a limit to the blast temperature above which the initial cost for the recuperator will increase considerably. Blast temperatures up to 500 or possibly 550 deg. C. can be obtained without the use of highly heat-resistant material. It is a matter of calculation whether the increased installation cost for a high-temperature recuperator would be justified by the additional fuel saving possible with higher air temperature.

Types of Recuperators

Various types of recuperators are shown in connection with cupolas in the next three diagrams. Fig. 10 represents a recuperator made up out of a bank of cast-iron tubes, over which the burnt cupola gas is passed, the blast going through the tubes. The outside of the tubes has either no fins or only very short ones. The surface area on the air side is greatly increased by ribs or needles. The smooth outer surface facilitates cleaning and also helps to keep the tube temperature low. Special arrangements are made to clean the outer tube surface by blowing it off with compressed air at regular intervals. Recently there has even been suggested the addition of some sand to the compressed air to get better cleaning effect.

Fig. 11 shows a recuperator, built up out of smooth, thin-walled heat-resisting tubes, through which the burnt cupola gas is led, the air passing over the outside of the tubes in a zig-zag pattern. The straight, cylindrical tubes can be cleaned out with a brush. The arrangement in the right half of Fig. 12 differs from Fig. 10 mainly in the situation of the gas take-off from the cupola shaft. By taking the gas out immediately above the melting zone, this design comes in a way near to the original Frauenknecht design, with the difference however, that it offers sufficient surface area in the recuperator for an efficient heat exchange, and that provision is made for burning the cupola gas, before it enters the recuperator.





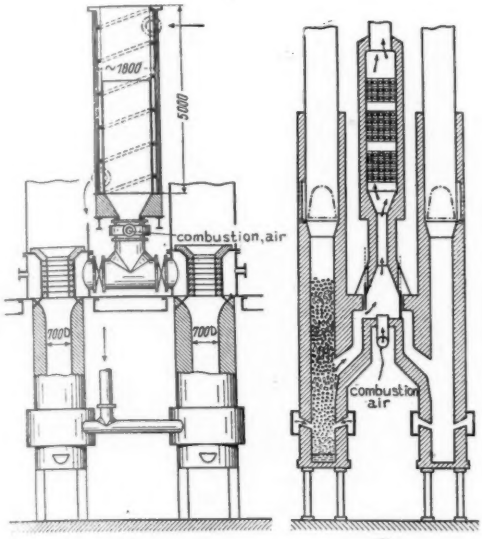
[According to Roesch

FIG. 11.—*Arrangement of a Hot-blast Cupola Plant (dimensions in millimetres).*

No provision seems to be made for dust elimination, and it appears just possible that dust problem has been overcome by extracting the gas at a level, where the slag is already partly molten, thus agglomerating any possible dust particles.

The left half of Fig. 12 shows a very interesting design for a recuperator, which has recently been described in fair detail by F. C. Evans[10]. This figure is rather somewhat simplified and does not show the cyclones, used to remove the dust from the cupola gas, on which Evans has given detail information.

In this recuperator type, heat transmission from the hot gas to the recuperator wall is rather more by radiation, whereas the transmission from the wall to the high-speed air-stream mainly depends on convection. All these systems have in common some gas or oil burner for the initial heating of the combustion



[According to Roesch

FIG. 12 (a).—*Simple Design of Recuperator for Small Cupolas.* (b) *Hot-blast Cupola Plant; Cupola Gas wtihdrawn 1 m. above Tuyères.*

chamber, a controlled air supply for burning the cupola gas (once the combustion chamber is hot enough to keep this combustion going), and, normally, some arrangement for cooling the air addition into the combustion chamber, to prevent overheating of the recuperator.

The combustion air is normally taken from the hot-blast pipe-line, as the cupola gas with its rather low calorific value tends to burn rather sluggishly with cold air. The addition of cooling air is apparently not required in the spiral recuperator (Fig. 12, left half) which, by its design, is less sensitive to overheating, than the other recuperator types. Because of the short life of the normal, non-cooled cupola lining, all these pictures show two cupolas, connected to one recuperator, so that the cupolas can be used alternatively. This has the disadvantage, that a number of hot gas and air valves are required, which will probably cause some leakage loss.

Modified Cupola Design

The whole set-up would be simplified considerably, if an efficiently-cooled lining were used, so that one cupola could be permanently connected to the recuperator. Apart from avoiding the above mentioned valves, it would probably be possible to have shorter pipe connections both for the hot cupola gas and for the hot-blast. The extra cost for the cooling system could be paid for out of the cost now normally spent on the second cupola. The cupola itself might also alter its shape, if things were taken to their final conclusion.

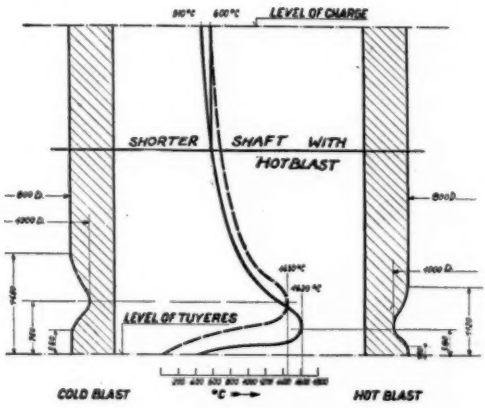


FIG. 13.—*Position of the Cupola Melting Zone with Hot Blast and with Cold Blast.*

It is well known that heat development in hot-blast melting is more concentrated towards the lower end of the furnace. This has been pointed out by various authors, thus Roesch and Mattern. Fig. 13 show a qualitative comparison of the temperature distribution for hot blast and cold blast over the height of the shaft[11].

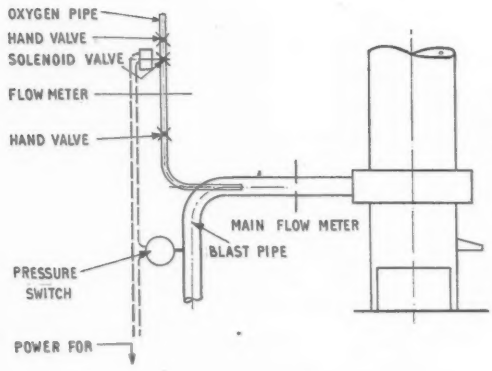
If with hot blast the same cupola top gas temperature would be allowed as with cold blast, the shaft could be shortened by perhaps ¼ or ⅓ of its normal depth. The extra heat loss in the cupola gas would be very small, but certain advantages might be gained. As the coke charges would travel a shorter way down the shaft, there would be less abrasion and it would be less important, to have very hard coke.

The gas rising up in the shaft would loose less pressure by friction in the load, and, for a given blower more pressure would be available at the tuyeres. Narrower tuyeres could be used with a similar effect to that shown by Kopecki.

Roesch[12] has stated that the arrangement according to Fig. 12, right half, requires only a blast pressure of about 10 in. water gauge against about 26 in. for normal cupolas. About 16 in. w.g. would therefore be available with a normal blower for use at the tuyeres and to overcome the flow resistance of the recuperator. If this arrangement also gave, as might be expected, a solution or part solution to the dust problem, then this, in connection with a water-cooled lining, narrow tuyeres and a permanently connected recuperator might be an almost ideal solution. Difficulties must of course be expected, if the shaft is shortened too much, so that it can no more act as a reservoir for the coke and iron charges. In such case even a short interruption of the charging process would cause irregular melting conditions.

Melting with Oxygen Addition

Several articles have been published in the past few years on the effect of oxygen addition to the



[According to R. O. Day, "Foundry," Sept., 1951, pp. 84 to 87

FIG. 14.—*Equipment for making an Oxygen Addition to the Cupola Blast.*

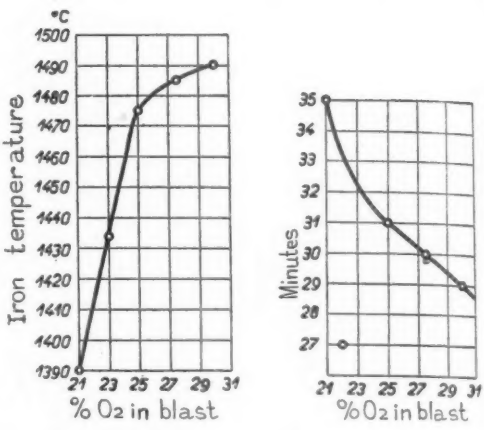


FIG. 15.—*(left) Average Iron Temperature at Cupola Spout plotted against Oxygen Content of the Air Blast; (right) Time required to reach Average Iron Temperature against Oxygen Content of Blast Temperature by Optical Pyrometer (not corrected).*

cold air blast for cupolas[13]. If a suitable source for oxygen is available, the further installation required for oxygen addition is very simple and inexpensive in comparison to a hot-blast installation.

R. O. Day[13] describes such an installation, which is shown in Fig. 14. The main parts in the oxygen line are:— a solenoid valve, operated from a pressure switch in the airline in such a way that the oxygen supply is cut off, if either blast supply or electric power fails; a flow-meter, a hand-operated regulating valve and a hand shut-off valve.

Normally not a continuous addition, but short time additions, lasting only a few minutes, are recommended, which are suitable to increase metal temperature and melting rate rapidly, if these have fallen off, say after a midday break or for other reasons. That oxygen addition has indeed this effect is shown by Jungbluth[14] in Fig. 15. These short-time additions of oxygen may be a comparatively cheap and effective means to counteract irregularities in the melting process of the cupola, but they also can become the cause of new disturbances. During the short time when oxygen is added to the air blast, combustion is speeded up roughly proportional to the oxygen content in the blast, and one of the effects can be that the height of the coke bed is lowered and the melting zone shifted to a lower level. To obtain uniform melting conditions it would rather seem preferable to make a continuous addition of oxygen, but for this the price of oxygen still seems to be prohibitive.

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[10] F. C. Evans. FOUNDRY TRADE JOURNAL, August, 1951, pp. 247-251 and September, 1951, pp. 279-282.
[11] Mattern. Loc. cit.
[12] Roesch. *Giesserei*. August 17, 1951, pp. 393-397.
[13] R. O. Day. *Foundry*, September, 1951, pp. 84-87.
[14] Jungbluth. *Die Neue Giesserei*, September 21, 1950, pp. 382-387.

(To be continued)

MORE THAN 700 people attended the annual dance which was organized by the Sports and Social Association of Herbert Morris & Company, Limited. It was held in the Town Hall, Loughborough.

A CONTRACT worth £500,000 has been placed recently with Robert Dempster & Sons, Limited, Elland (Yorks), by the British Electricity Authority for coal-handling plant for the Stella Haugh power station being built at Blaydon-on-Tyne (Co. Durham).

THE BOARD OF TRADE announced on Tuesday that a new reference has been made to the Monopolies and Restrictive Practices Commission: it is to investigate the supply and exports of certain electric generators, electric motors and transformers, and steam and hydraulic turbines for driving heavy alternators. Any person or organization wishing to offer evidence should write to the secretary of the commission, 3, Cornwall Terrace, London, N.W.1.

ART BURSARY AWARDS.—The Council of the Royal Society of Arts, adopting the recommendations of the Industrial Art Bursaries Board based on the reports of the juries, have awarded bursaries amounting in value to £1,750. Amongst the following awards and commendations made in connection with the 1951 competition for domestic appliances were:—*For Domestic Gas Appliances*, a bursary (£25) to Mr. Gervase James Geoffrey Elwes (L.C.C. Central School of Arts and Crafts; aged 24), and for *Domestic Solid-fuel-burning Appliances*, a bursary (£150) to Mr. James Scott Smith (L.C.C. Central School of Arts and Crafts; age 23).

Foundry Mechanization

Discussion of Mr. A. S. Beech's Paper

At the March meeting of the Birmingham branch of the Institute of British Foundrymen Mr. A. S. Beech, M.I.MECH.E., gave a modified version of the lecture he originally presented to the Institute of Mechanical Engineers.* After the presentation of the lecture, which was enhanced by the showing of a film, Mr. Beech was accorded a vote of thanks, proposed by Mr. Blackford and seconded by Mr. Blythe. After acknowledgment by the lecturer, a discussion ensued of which the following is an abstract:—

MR. BLYTHE referred to the question of the opening of a sand hopper over a moulding machine, shown in the film, and said that it seemed to him that it was positioned in such a way as to be very tiring to the operator, and the thought the film had in fact indicated that it was something of an effort. He suggested it would have been easier to have pulled the lever down.

MR. BEECH agreed that this would be simpler.

MR. PEELING said that he had experienced trouble with the system sand. After this had been in circulation for some time, the warm sand was found to adhere to the patterns, and he asked whether Mr. Beech had experienced this, and how it could be overcome.

MR. BEECH agreed that the sand did get hot as it was used during the day. The method usually employed was to turn the sand over during the course of its travels. This was the easiest and best way of getting rid of the steam in the sand, which meant reducing the heat.

MR. MARTIN asked whether Mr. Beech could say whether foundry mechanization had ever been associated with motion-study, and whether it would be worthwhile.

MR. BEECH said that motion-study had been used, especially in the U.S.A., and also in this country. This had given much assistance by the cutting out of operations, etc.

Moisture Control

MR. HALL asked whether there was any automatic and foolproof method of controlling the moisture content of the sand.

MR. BEECH said this was certainly difficult when using natural-bonded sands. Sometimes the sand came in in a very wet condition, and it did create difficulties, but it had been found that by taking tests regularly during the day it could quite effectively be controlled. The sand should, of course, be stored under cover. Generally speaking, there had not been any systematic way of doing it by machinery, but if tests were taken at intervals during the day and a close supervision kept, the moisture content could be controlled.

MR. TWIGGER asked in this connection whether Mr. Beech advocated moisture tests of a continuous-testing type at some point near to the sand mill, and whether it would be possible to have some automatic indicator, or whether he preferred to rely on indicator readings and then adjust the amount of water by hand.

MR. BEECH said that using a speedy moisture tester, usually the best place to take samples was off the top of the feeder belt, because it gave results for the final sand before it was used for moulding. The question of adding moisture into the mill depended on whether synthetic or natural sands were being used. If natural sand was employed this was difficult as it came in more moist, but with synthetic sand it was much easier.

MR. DIXON asked whether, in this way of working, it was not too late to improve if things were wrong.

MR. BEECH said that normally there was a moisture content of 3½ per cent. with synthetic sand and 4½ to 5 per cent. with natural sand. Certainly if it rose to 8 or 10 per cent. there would be real trouble, but in a well-run plant this should never occur.

MR. FRANCIS said that he had noticed in the film that the machine moulders were using facing sand and that this seemed to him to be a disadvantage. He asked whether this facing sand was necessary.

MR. BEECH explained that facing sand, as a rule, was not used in a mechanized plant and that in the film shown, and sand referred to by Mr. Francis was not actually a facing sand, but was ordinary sand specially sieved to give a superfine finish for a particular job. In the majority of cases its use was unnecessary.

Dust Arrester

MR. SHORE referred to a knock-out shown in the film and to the reference to a wet dust-arrester plant. He said he would like to know something more about this, whether the dust was taken off above or below the grating; if any extra air was added, and what sort of water filter was used.

MR. BEECH said that on the question of dust-extraction plants he was not an expert, and could not say a great deal about it, except that it was installed by a well-known English and American company, and if Mr. Shore would like further information, he would certainly obtain details for him.

MR. BROMWICH referred again to moisture control and said he had recently had the opportunity of inspecting a plant on the Continent where they were controlling the moisture going into the batch mill, which was operating very well by water being added at this point. Various sizes of moulding-boxes were being used. Another point he would like to know was whether the boxes shown on the

* A slightly abridged account of this Paper was printed in the JOURNAL, March 13 and 27, 1952.

slides referring to the railway foundry were returned in pairs to the moulding machines, and if they would always remain in pairs. He also asked about the pins in the moulding-boxes.

MR. BEECH said that the moisture content could be controlled in the mill when synthetic sand was used, but when using natural sand it was a more difficult problem. He always advocated the use of the former. As to the pins in the moulding-boxes, Mr. Beech said that these were simply to hold the boxes together; the registration pins on the boxes were very different and had a clearance of about ten " thousandths." No trouble was experienced with the holding pins in the boxes.

Crushing the Sand Grain

MR. HALL referred to the question of natural *versus* synthetic sands, and said that with a mechanized plant, when adding natural sand, it amounted to 2½ to 3 per cent. to the sand being used, and the moisture in the natural sand would not have any predominant effect. Mr. Beech had claimed that the virtue of the sand mill was that it did not crush the grains but he, himself, thought this was a myth and that it had led to an elaboration of sand mills which was completely unnecessary. He would like to ask if Mr. Beech had any figures on the possible temperature drop of sand through the disintegrator.

MR. BEECH replied regarding the crushing of the silica grains. He said that this did happen in the very heavy type of sand mill, or brick crusher or mortar mill. In his younger days, mills were made of a very heavy type, and during the last 25 to 30 years, sand mills had tended more and more to use lighter rollers, to prevent crushing of the sand grain. He maintained that with a stationary pan and a very narrow roller over the top of the sand, the grain was bound to be crushed, and tests had been made to prove this. He pointed out that, recently, one of the largest manufacturers of sand mills in the world had suspended the mullers on springs to prevent a heavy mass of metal coming on top of an inert mass of grain. Mr. Beech said he had taken tests before putting in the sand, and after it was taken out, and there had been a definite reduction in grain size. He maintained that those results were quite indisputable.

MR. RUSTON asked whether it would be possible to do away with the crusher by incorporating a chain flail in the rotary screen.

MR. BEECH said that the castings made in the film sequence shown were made up to 35 tons in weight, with the result that heavy blocks of sand had to be reduced in size. Consequently the crusher was used, and the screen was then used to take out the parts of bricks, etc., which were present and which must be eliminated. He thought it was very doubtful whether the crusher could be replaced by other plant.

MR. SKINNER asked whether difficulty had been experienced with the down-sprues and runners and where these were removed, as his firm had experienced difficulty due to moulds failing to release their castings on the vibrator.

MR. BEECH said that the sprues and runners were removed after they passed up the hot-casting conveyor and passed on to the cooling conveyor. No difficulty had been experienced at all with moulds failing to disintegrate.

Initial Teething Troubles

MR. WEAVER said he felt that Mr. Beech had made things look very pleasant in a mechanized foundry and it appeared to be a simple matter to produce good castings, but he would like to know what the settling-down period was on a mechanized plant, and what the average percentage of scrap was likely to be.

MR. BEECH said in reply that he had never known a mechanized plant to start up without some teething troubles. If, however, the plant was well designed and well run there was no doubt that scrap percentage could be quite normal. It was difficult to give any figures, as this depended to a great extent on the type of castings being made.

MR. TWIGGER said Mr. Beech had mentioned the question of sand-rammers taking boxes up to a certain size and asked what was the minimum size.

MR. BEECH said that the smallest size he knew of was the " Minor " sand-rammer which coped with boxes about 36 by 24 in. He did not think it advisable to go much below this, because the spillage was always excessive on the smaller boxes.

MR. ROGERS referred to the scrap present in the sand and to the sparks emanating from the sand-rammer, and said he would have thought metal in the sand was likely to be detrimental to the castings.

MR. BEECH said that the sparks issuing from the sand-rammers were caused by the close proximity of the blades to the casing. It was, he said, very difficult to remove every small particle of metal from the waste sand, although to overcome this they had installed a magnetic disc over the rammer which had done a great deal to avoid the trouble.

MR. ROGERS said that Mr. Beech had stated in the lecture, when referring to the railway foundry, that the cooling time was normally twenty-two minutes. Mr. Rogers thought this was rather short for a railway chair.

MR. BEECH explained that from experiments carried out before the plant was started they had found that eighteen minutes was perfectly safe, and the twenty-two minutes had proved to be ample.

MR. HALL asked Mr. Beech if he had mechanized many foundries to produce the same output as before being mechanized and, in which case, whether there had been any reduction in cost.

MR. BEECH said that the main point of mechanization was usually on the question of production. Mechanization gave an increased production of castings per man.

MR. TWIGGER at this point had to bring the discussion to a close, and expressed again the appreciation and thanks of the Birmingham branch for a most interesting lecture and discussion.

Institute Elects New Members

At a meeting of the Council of the Institute of British Foundrymen held at the Café Royal, Regent Street, London, on March 29, the following were elected to the various grades of membership:—

First List

As Subscribing-firm Member

John I. Thornycroft & Company, Limited, Woolston Works, Southampton, shipbuilders, engineers and ship repairers (representative: Dr. O. P. Einerl, F.I.M.).

As Members

E. C. Brough, chief metallurgist, H. W. Lindop & Sons, Limited, Walsall; Dr. O. P. Einerl, F.I.M., chief metallurgist and foundry manager, John I. Thornycroft & Company, Limited; A. J. Elston, joint managing director, Progressive Pattern Equipment, Limited, Stratford, London, E.15; W. Fovers, managing partner, Precise Castings, Limited, Derby; P. M. Gavin, steel foundry manager, English Steel Corporation, Limited, Sheffield; A. J. Gulliford, works manager, J. W. Singer & Sons, Limited, Frome, Somerset; J. E. Kilminster, foreman patternmaker, Fine Castings, Limited, Fishponds, Bristol; L. C. N. Kilby, director, Progressive Pattern Equipment, Limited, Stratford, London, E.15; J. S. Morton, director, Campbell & Gifford, Limited, London, S.W.1; C. D. McClelland, director, Hall & McClelland, London, W.1; F. B. Ollerenshaw, foundry manager, Davy United Engineering Company, Limited, Sheffield; D. M. Robertson, foundry works manager, Newton Chambers & Company, Limited, Thorncliffe Ironworks, near Sheffield; A. P. Wright, chairman and managing director, T. M. Birkett & Sons, Limited, Stoke-on-Trent; F. N. Smith,* foundry manager, Central Foundry Company, Limited, Oldbury; H. Taylor,* managing director, Taylors Foundry, Limited, Alperton, Mddx; J. W. Watson,* foundry superintendent, Brown, Lenox & Company, Limited, Pontypridd.

As Associate Members

C. W. Brown, chief estimator, High Duty Alloys, Limited, Slough; R. S. Bushnell,* technical representative (Beetle Bond), British Industrial Plastics, Limited, Oldbury; G. B. Connop, sales department assistant, Hale & Hale, Limited, Tipton; G. A. Cooke, proprietor, "Athena," pattern, model and art manufacturers, Coventry; F. Danks, methods engineer, F. H. Lloyd & Company, Limited, Wednesbury; R. N. Dickson, chargehand patternmaker, R. C. Gibbons & Company, Birmingham; R. Dunn, assistant foundry manager, English Steel Corporation, Limited, Sheffield; G. R. Harrison, light-alloy moulder, Bristol Aeroplane Company, Limited; R. Harvie, foreman, Cockburns, Limited, Cardonald, Glasgow, S.W.2; W. H. T. John, assistant foundry manager, John Jones & Sons, Limited, Loughborough; O. P. Luther, foundry superintendent, Tata Chemicals, Limited, Mithapur, India; G. Martin, research student, University of Birmingham, Birmingham; F. R. W. Mason, foundry manager, Morris Engineers, Limited, Great Bridge, Tipton; D. Mavrocordatos, student, the University, Birmingham, 15; A. G. May, acting foreman, Torrance & Sons, Limited, Bristol; J. McConnell, steel moulder, Atlas Steel Foundry & Engineering Company, Limited, Armadale, West Lothian; P. McMahon, foreman patternmaker, Bonnington Castings, Limited, Leith; P. G. Pennington, manager, Pease & Partners, Tees Foundries, Limited, Middlesbrough; G. Smith, foundry technician, John Maddock & Company, Limited, Oakengates, Salop; R. Southern, chief draughtsman, Incandescent Heat Company, Limited, Smethwick; D. C. Spencer, matrix maker, S. Russell & Sons, Limited, Leicester; E. D. Sykes, foreman patternmaker, Slough Foundries, Limited; J. G. C. Tolcher, foundry foreman, British Thomson-Houston, Limited, Rugby; E. Turton, foreman patternmaker, Newton Chambers & Company, Limited, Sheffield; D. G. Whitehouse, chief draughtsman, English Steel Corporation, Limited, Sheffield.

As Associates (under 21)

N. D. N. Banerjee, foundry assistant, c/o Commissioner for the Port of Calcutta (student, National Foundry College); J. B. Bell, student, N.F.C.; G. Durrant, coremaker, Hamworthy Engineering Company, Limited, Poole; D. Kirkpatrick, patternmaker, Head Wrightson & Company, Limited, Thornaby-on-Tees; D. W. Leonard, metallurgist, John Fowler & Company, Limited, Leeds; H. Parrack, student, N.F.C.; B. Priestley, foundry metallurgist, Modern Foundries, Limited, Halifax; D. W. Thompson, engineering apprentice, "Ministry of Supply," Royal Ordnance Factory, Nottingham (N.F.C. student); R. J. Williamson, metal patternmaker, Ford Motor Company, Limited, Dagenham; J. Smith, metal patternmaker, Ford Motor Company, Limited.

As Associates (under 21)

B. Bancroft, student foundry apprentice, Stanton Ironworks, Limited; M. B. Brown, student apprentice, Brightside Foundry & Engineering Company, Limited, Sheffield; D. C. Cook, patternmaker, R. & A. Main, Limited, Edmonton, London; J. P. Datson, apprentice moulder coremaker, J. Stone & Company, Limited, London; E. Doran, apprentice patternmaker, Briggs Motor Bodies, Limited, Dagenham, Essex; J. A. Eales, apprentice moulder, Harland & Wolff, Limited, North Woolwich, London, E.16; G. A. Gardner, apprentice moulder and coremaker, J. Stone & Company, Limited; J. B. Howard, student engineering apprentice, Stanton Ironworks Company, Limited; M. C. Hughes, trainee in metallurgy, Deloro Stellite, Limited, Birmingham; P. Kay, foundry apprentice, Manlove Alliott & Company, Limited, Nottingham; B. J. Quigley, apprentice patternmaker, Transport Equipment (Thornycroft), Limited, Reading; B. E. Rule, apprentice patternmaker, Light Alloys, Limited, Willesden; D. Taylor, apprentice patternmaker, Park Foundry (Belper), Limited, Derbyshire; W. K. Tyler, foundry and general engineering trainee, Ley's Malleable Castings Company, Limited, Derby; V. J. Yeend, apprentice patternmaker, Briggs Motor Bodies, Limited, Dagenham.

Second List

As Members

A. Clay, foreman coremaker, Fraser & Chalmers, Limited, Erith; F. A. Davies, chief draughtsman, Venesta, Limited, London; D. A. Lyster, general manager, Demerara Foundry Company, Limited, Georgetown, British Guiana; A. M. Sandles, foundry foreman, Fraser & Chalmers, Limited, Erith; H. H. Hamilton,* technical representative, Corn Products Company, Limited, London; H. Jarratt,* foundry manager, W. C. Holmes & Company, Limited, Huddersfield.

As Associate Members

A. S. Cunningham, foundry foreman, R. Taylor & Company (Ironfounders), Limited, Larbert, Stirlingshire; S. R. Ferguson, patternmaker, J. F. Passe & Company, Paisley; H. Foster, assistant foundry foreman, Metal Box Company, Limited, Shipley; M. Froumin,

* Transferred.

Institute Elects New Members

director, Wilmor & Sons, Limited, London, E.C.1; E. S. Gargan, student teacher, Jordanhill College, Glasgow; P. Hume, patternmaker, R. Taylor & Company; G. M. Johnston, foreman patternmaker, Cameron & Roberton, Limited, Kirkintillock; G. H. Kane, iron moulder, Richardsons Westgarth & Company, Limited, Hartlepool, Durham; W. Molloy, technical representative, Wm. Cumming & Company, Limited, Glasgow; P. McAlpine, foreman patternmaker, North British Locomotive Company, Limited, Glasgow; D. C. Nevin, foundry superintendent, Rio de Janeiro Tramway, Light & Power Company, Limited, Brazil; S. R. Pearson, engineers' patternmaker, British Bath Company, Limited, Greenford, Mddx; G. E. Hawthorne,* partner, Hawthorne & Lea, Bradford; N. A. MacQuarrie,* shift supervisor, Glacier Metal Company, Limited, Mddx.

As Associates (*over* 21)

G. S. Burn, moulder, C. A. Parsons & Company, Limited, Newcastle-upon-Tyne; G. M. G. Henderson, assistant technologist, R. Taylor & Company; G. H. Hirts, brass moulder, L. Hirst, Limited, Brighouse; K. R. Sewell, student, N.F.C.

As Associate (*under* 21)

J. Q. Dickie, apprentice moulder, Paisley Brassworks Company, Limited.

Third List

As Subscribing-firm Member

William Crosland, Limited, Stockport Road, Bredbury, near Stockport, engineers and ironfounders (representative: W. E. Yarwood).

As Members

S. Hopwood, M.B.E., northern technical representative, Aero Research, Limited, Cambridge; W. Walsh, technical adviser, G. Tweedy, Limited, Chipping; W. E. Yarwood, Wm. Crosland, Limited, near Stockport.

As Associate Members

I. C. Broughton, director and works manager, Thomas Carling & Company, Limited, Bolton, Lancs; J. E. Cook, metallurgist, Sandholme Iron Company, Limited, Todmorden; F. Heaton, assistant manager, Forcast Foundries, near Colne, Lancs; A. Jones, foundry foreman, Joseph Berry, Limited, Swinton, Lancs; D. Paterson, foundry metallurgist, Howard & Bullough, Limited, Accrington; P. Quinn, foundry foreman, McGregor, Limited, Leigh; G. Taylor, non-ferrous foreman, W. H. Bramhall & Company, Limited, Manchester; B. Wild, foundry foreman, Platt Bros. & Company, Limited, Oldham; V. Hocking,* loose-pattern moulder, Yew Tree Iron Works, Hollinwood, Oldham.

As Associate (*over* 21)

E. W. Blackburn, apprentice patternmaker, Kendall & Gent, Limited, Gorton.

As Associates (*under* 21)

H. Chapman, apprentice moulder, John Hall & Son, Limited, Oldham; W. Grace, apprentice iron moulder, John Hawthorn & Company, Limited, near Stockport.

* Transferred.

strated with the use of models, the making of various types of pattern-plates for repetition moulding. Several illustrations of typical work done by the speaker were also shown. In his concluding remarks Mr. Conacher thanked Mr. Shaw for his excellent contribution to the section's first year's activities. He also thanked, for their help and co-operation, Mr. N. Crawford, the projectionist, and Mr. Brown of the Imperial Hotel.

Notes from the Branches

London—East Anglian Section

The East Anglian section of the London branch of the Institute of British Foundrymen held their March meeting in the Lecture Hall, Central Library, Ipswich, on March 18, when the subject matter for the evening was a symposium on feeding techniques. The president of the section, Mr. V. W. Child, opened the discussion by saying that it covered three sections of the foundry industry, steel, cast iron, and non-ferrous, and members were fortunate in having these techniques presented by the staff of local foundries. The section on steel was given by Mr. W. L. Hardy (Lake & Elliot, Limited), on cast iron by Mr. W. E. Cates, (Reavell & Company, Limited), and on non-ferrous by Mr. L. Ribchester (Crane Limited).

Steel.—Mr. Hardy dealt with new feeding techniques, such as the adoption of "Washburn" feeding principles and, with slides, illustrated various examples of this method, which is widely used by his firm. He said that the chief advantages of this method of feeding were castings more sound and true to pattern than by older feeding techniques, and the reduced oxy-acetylene cutting and grinding; and the chief disadvantage was the increased coremaking involved.

Cast Iron.—Mr. Cates outlined by slides and diagrams various running and feeding techniques employed in the foundry of Reavell & Company, Limited. These techniques varied according to the size and type of casting being made, and the illustrations covered a wide field of foundry techniques. In this section, Mr. Cates emphasized that all castings were run with metal as hot as possible, believing in the principle that hot metal will feed considerably better than sluggish and dull metal.

Non-ferrous.—Mr. Ribchester outlined methods employed at Crane Limited, to run and feed non-ferrous castings in various alloys. He emphasized that in non-ferrous founding it was necessary to gate and feed to eliminate dross and scum from being entrapped in the casting and illustrated by means of slides and sketches some typical systems employed to overcome this problem.

A lively discussion followed, and subsequently a vote of thanks to the lecturers was proposed by Mr. K. Bolton, who said that the section was indebted to Mr. Hardy, Mr. Cates and Mr. Ribchester for their excellent presentation of feeding techniques. He was agreeably surprised that such great strides had been made in the "Washburn" method, and he also congratulated Mr. Cates on being able to make gearwheels weighing up to ½ ton with a runner-type feeder which appeared to be so small. He could confirm that they were sound in every respect because he had personally inspected the castings. The vote of thanks was seconded by Mr. H. S. Ward.

Scottish—N.E. Section

The last meeting of the 1951-52 session of the North East section of the Scottish branch of the Institute of British Foundrymen was held at the Imperial Hotel, Arbroath, on March 19, with Mr. H. Conacher, the vice-president, in the chair. The meeting opened by dealing with the annual business. The secretary's report and the financial statement were presented and the meeting accepted a proposal that all the present officers should be re-elected for another year. Mr. R. R. Shaw then gave a talk entitled "Patterns for the Repetition Foundry." Mr. Shaw discussed in detail, and demon-

(*Continued at the foot of col.* 1)

Income Tax for Individuals

By F. J. Tebbutt

With many alterations by the 1952 Ways & Means Resolutions (the Budget) in connection with income tax, as regards personal allowances, tax poundages, and the like, this explanation is given showing how the individual taxpayer stands after the changes. These alterations as regards schedule D (business profits and persons on own account) will apply against income in year ending April 5, 1952 (or earlier date according to the financial year ending date of the firm concerned, *e.g.*, December 31, 1951). The actual payment of tax from the assessments arising therefrom will be required in equal instalments on January 1 and July 1, 1953. For schedule E (employments: pay as you earn) the alterations apply from April 6, 1952, but effect will not be given to them before June 8.

Tax Poundages and Personal Allowances

Statements are often loosely made as if there was only one tax poundage and that at the standard rate (*i.e.*, the highest), but this, of course, is not so, as there are other rates of lower poundages; up to the present there were two. Now, by the 1952 Budget (shortly to be in the Finance Act, 1952) there are three "reduced rate" poundages, the lowest at 3s. now applying to the first £100 of taxable income (taxable income is total income less personal allowances, of which more later). Against the next £150 of "taxable income," the poundage is 5s. 6d., and then 7s. 6d. against the taxable income from £250 to £400, and only then does the standard poundage of 9s. 6d. apply. This means that the reduced rates apply to the first £400 of taxable income, the standard rate (9s. 6d.) only coming in the "picture" on any taxable income over £400. Previous to these alterations, the 3s. rate applied to the first £50 of taxable income, then on the next £200 the 5s. 6d. rate applied, and then the standard rate of 9s. 6d. come into effect after the first £250 of taxable income. Personal allowances have been increased, also making for lower taxable incomes. The earned income relief, now two-ninths (up to a maximum deduction of £450, or earnings of £2.025 p.a.) was formerly one fifth. For each individual there is allowance of £120 (increased from £110); for a wife £90 (previously £80), and for each child £85 (from £70). Individuals whose total income is below £250 p.a. will receive the earned income relief of two ninths, whether the income is earned income or investment income.

Where No Tax is Payable

If all income is earned, a single person will not pay tax unless the total income exceeds £154; a married couple unless total income exceeds £270; a man, wife, and one child unless total income exceeds £379; a man, wife and two children, unless £488 is exceeded; and a man, wife, and three children, unless total income exceeds £597; up to all these limits the deductions of the relevant personal allowances leave no taxable income. Taxpayers of the five classes mentioned would, last year, instead of being exempt, have paid in tax £1 19s., £3 18s., £6 9s., £10 5s., and £15 4s., respectively.

Stages before Standard Rates Applies

The standard rate of 9s. 6d. is not paid unless, in the case of a single person, total earned income exceeds £668 11s. 5d.; a married man unless it exceeds £784 5s. 8d.; a man with a wife and one child—£893 11s. 5d.; a man with a wife and two children—£1,002 17s. 1d.; and a man with wife and three children £1,112 2s. 10d. Taxpayers with incomes at these figures would last year have paid in tax £145, £151, £159, £167, £176, respectively. If the total incomes for the five different classes of taxpayers as above were £475, £591, £700, £810, £919, respectively, the tax payable now would only come under the 3s. and 5s. 6d. rates, the taxable income being in each case £250, so that the tax payable in each case would be £56 5s. (£100 at 3s., £150 at 5s. 6d.). Last year such incomes would have attracted tax payments of £72, £78, £86, £94, and £102, respectively, part of the income coming on to the standard rate.

Other Details

In computing the figures given earlier, only the basic personal allowances have been taken into account, but if any taxpayer is entitled to other personal allowances (*e.g.*, housekeeper allowance £50; independent relatives £50) which might well be the case in some instances, then the figures given would vary and there are also "wear and tear" allowances for machinery and plant (term a wide one, including motor vehicles and fittings and fixtures) for which the taxpayer may be eligible. In such cases, the taxable income would work out at a lower figure and the limits of income given correspondingly higher. If the wife has earned income, that amount attracts the "earned income" allowance of two-ninths as well as the husband's earned income, and there is also a special allowance of seven-ninths of the wife's earned income up to a maximum allowance of £120. This is additional to the £90 included in the husband's personal allowance of £210 for man and wife for any income.

Releases of Industrial Graduates

Appealing to industrialists to release graduates in order to enable them to take advantage of a course which Birmingham University has planned for metallurgists to bring them up to date with recent developments, Professor A. J. Murphy, professor of industrial metallurgy, said that British industry was slow getting off the mark, and one of the department's difficulties was to fend off foreigners who were anxious to take the course which he thought should primarily be for British graduates.

Professor Murphy was speaking on "The University and the Metal Industry" at a luncheon of the Wolverhampton Rotary Club on April 1. Metallurgists, he said, have now to work not only in the laboratory but in industry on the production side, for production is increasingly demanding for its success men of university calibre. He stated that Birmingham University had decided, after the war, to extend the orthodox metallurgical training by industrial training, so that the graduate could be fitted into industrial work more expeditiously. Industry had approved the project to the extent of providing £160,000 for laboratories and thus the Department of Industrial Metallurgy came into existence in 1946. Now the Department wanted to serve earlier graduates by its post-graduate course which will be in the nature of a refresher.

New Catalogues

Woodworking Machinery. Bolinders Company, Limited, of 4, Lloyds Avenue, London, E.C.3, have sent us a four-page leaflet which illustrates and describes the "Superior" universal shaper. This model dispenses with a pedal for raising and lowering the table, and all movements are hand-controlled. Two models are available. The machine is of Swedish origin.

Mechanical Handling Plant and Foundry Equipment. A brochure received from the Hepburn Conveyor Company, Limited, Rosa Works, Wakefield, raised the question of when is a catalogue not a catalogue? Actually there is but little of the appearance of the usual "catalogue," for the preponderating bulk of book is a fine collection of captioned pictures.

Pneumatic Conveying Installations. Davidson & Company, Limited, of Sirocco Engineering, Belfast, Northern Ireland, have sent us a 78-page catalogue, carrying good strong cardboard backs, covering in great detail every phase of pneumatic conveying. As sand is not included in the survey, the main interest is for the patternshop, where this method can be used to advantage for collecting sawdust.

Electrically-heated Bale-out Furnaces. A leaflet received from the Hoyt Metal Company of Great Britain, Limited, London, S.W.15, describes and illustrates a line of electrically-heated, bale-out melting pots. These have been designed for tin, white metal and other low-melting-point alloys, as the temperature range is controlled to give between 100 and 500 deg. C. Four types are available ranging from 6 to 24 kw. rating.

Vibratory Screens and Feeders. Two leaflets have just been issued by Podmores (Engineers), Limited, of Pyenest Street, Shelton, Stoke-on-Trent. One deals with a vibratory screen, which we suspect from the location of the works is designed with the ceramic industry in mind. The screen is 36 by 24 in. and handles up to four tons per hour. The second describes a vibro-electric feeder, having an infinitely variable feed.

Non-ferrous Products. Vickers-Armstrongs, Limited, Elswick Works, Newcastle-upon-Tyne, 4, have just issued what must rank as the best non-ferrous data book for designers so far published. There is in its 45, well-illustrated pages a mass of tabular matter which seems to have been specially prepared to help the designer in his choice of material available in standard sizes. The part dealing with sand castings is somewhat meagre, and is dismissed with pictures of the foundry and a melting furnace, and a page of specifications. A group of typical castings might usefully have been included. The book is nicely presented, except for the spiral binding, where the rings are too small for the thickness and, without much persuasion, the book refuses to close.

Dust Collection. From Air Control Installations, Limited, Ruislip, we have received two publications—one of which describes a range of Airmat dust arresters, wherein the dust-laden atmosphere passes through "air mats." These are standardized, but the casings are varied according to application. The second catalogue describes a quite different sort of dust-collector. In this case, two endless chains, suspended vertically between geared wheels carry overlapping panels so as to form a curtain. The rotating curtain in its lowest position passes through an oil-bath, which washes off the dust and re-coats the vanes ready for the next circuit. A scraper tool and a sludge receptacle form part of the standard equipment. These two interesting catalogues are available to our readers on writing to Ruislip.

House Organs

Alloy Metals Review. Vol. 8, No. 61. Issued by High Speed Alloys, Limited, Widnes, Lancashire, England.

This issue contains a very useful review of data on the heat-treatment of grey cast iron. It takes the form of an article by Mr. M. M. Hallett, M.Sc., chief metallurgist, Sheepbridge Engineering Company, Limited, of Chesterfield.

Cracks and Crazes. Vol. 3, No. 2. Issued by M. N. Cockburn and Company, Limited, Gowanbank Ironworks, Falkirk.

It would be appreciated by outsiders, such as the reviewer, to see printed, the more prominently the better, the name and address of the Company. This issue reports the death, scarcely two years after his retirement, of Mr. James Faichnie, who spent 53 years with the firm, 30 of which were as foreman moulder. A service is given to the industrial reader by an article on "Disablement benefits," and cognate subjects. A new feature "book reviews" has been added.

Bulletin No. 28. Issued by the Association of Bronze and Brass Founders, 29, Bennetts Hill, Birmingham, 2.

This is by far the best bulletin so far issued. It is full of just the information the members of an association desire to have in their possession and must make the average member fully aware of the Association's ever-increasing activities. The regular district meetings which are well reported give opportunities for full participation in the affairs of the Association. Technology is well to the fore and this issue carries two reprints of important articles taken from the technical Press. Amongst news items reported are: The output of alloys conforming to B.S.I. 1400 specifications was shown by a six-month survey to be 85 per cent. of the total. Thus a booklet on this subject, compiled to interest designers, is under consideration. Moreover, "stickers" are to be designed to help in the campaign to reduce the number of non-standard alloys now being called for. Attention is being given to the recovery of metals from skimmings and ashes, and data are being collected as to the exent modern processes are being used in the industry.

The worth of fracture tests such as are being used in America is being evaluated. The results so far reported show promise. The Association prepared evidence which was submitted to a tribunal charged with making a decision as to whether the Mansfield Sand Company should or should not be allowed to exploit ground for the future supply of moulding sand or whether it should be utilized as a building estate.

Cupola Supply to Open-hearth Furnaces

An article in the *Iron Age* issue of February 28, 1952, describes and illustrates the working of 15-tons per hour cupolas for providing liquid metal to the open-hearth furnace, so replacing bought pig-iron, as an all-scrap charge is used. They run 72 hours before shutting down for relining. It is claimed by this system that the users—the Central Iron and Steel Division, Barium Corporation of Harrisburg—are saving $3.74 a ton over the former practice of using pig-iron. The iron is de-sulphurized before passing to the open-hearth furnaces. The make is of the order of 360 tons a day.

Dust Problems in Foundries

I.B.F. London Branch Discussion

(*Continued from page* 384)

Dust Sampling and Wetting

A SPEAKER commented that in the film it appeared that the conditions for the men working with the swing-frame grinder were alarming. It was stated subsequently that the conditions were not dangerous, but he asked for Mr. Lawrie's views on the matter. He also asked whether it was possible to measure the "dangerous-dust" content of the atmosphere. Finally, inasmuch as the dust particles were airborne because they were dry, he wondered whether it was possible to apply moisture to prevent the particles from rising.

MR. LAWRIE could not give off-hand the information concerning the silicosis hazard attaching to the various processes depicted, but it was published in the medical report by Dr. A. I. G. McLaughlin previously quoted. The standard instrument for measuring the amount of dust was the thermal precipitator, but it was heavy and cumbersome and gave only one or two samples a day. With it, he had himself obtained dust concentrations of about 150,000 particles per ml.; it was used more or less as a standardizing instrument. In foundries, the Owen's jet counter was used and it gave a snap sample. It was perhaps only about 40 per cent. efficient; but a technique had been developed by which samples could be estimated at the rate of 50 to 70 per hr. So that it was felt that to deal with very large numbers of samples on a statistical basis might be as good in the long run as to have a much smaller number of so-called "absolute" samples, which did not show "surges." These instruments gave the dust concentration in particles per ml. In order to measure the "dangerous-dust" content, bulk samples had to be taken on salicylic acid or naphthalene filters. It should be appreciated however that even the so-called bulk sample gave only enough dust for chemical analysis by micro methods. So that whilst it was true to say that dust clouds could be estimated with respect to danger, the work was slow, tedious and demanded a high level of experimental skill from the analyst. Another method of estimating the danger of a dust cloud was to carry out routine medical examinations of the people exposed to it.

It was just about impossible to wet dust particles within the size range in which the investigators were interested. That was due to the surface tension of water; the water simply would not "bend" round particles so small, and that was why wetting agents had been tried. Another difficulty was that, even if the particles were wetted, they did not remain wet for very long; the water evaporated very quickly. One sometimes got a higher concentration of small particles if the dust were wetted than would otherwise be the case. It seemed that increased humidity allowed electrical charges to leak away, so that aggregates of dust particles disintegrated. Very much more information was needed on wetting methods, and efforts were being made to get it.

Atmospheric Recirculation

MR. O. H. JACOBSEN, referring to the K. & L. fettling bench, having filters and a fan beneath it, asked whether it used any special type of filter, and what was the frequency with which filters needed replacing or cleaning. In certain circumstances, the air discharged by a fan was re-circulated into the workroom. His colleagues and himself dealt with dust-extraction primarily, and in that connection there were all sorts of requirements by H.M. Inspectors of Factories, which requirements were often found to conflict. Sometimes they were told that they must not return filtered air to the workroom because the finest dust escaped the filters, and that was the dust which was most harmful to health. On other occasions, they were told that it was all right to return the filtered air. Mr. Jacobsen asked what really was the true requirement in that respect, for it was a matter which probably affected all, whether foundrymen or designers of ventilating equipment.

In connection with the stand grinder as shown in the film there was reference to a standard exhaust. He did not know the capacity of the exhaust in that particular case, but he believed the wheel was of 30 in. dia. and, so far as he could see, the exhaust was of relatively low volume. Asking whether Mr. Lawrie considered that it was of sufficient volume, he said it appeared to be only about 50 per cent. of the volume he himself would apply to a grinding wheel of that size. The volume might make quite a substantial difference to the results, and he asked whether the standard outfit had been tested with varying rates of exhaust, as opposed to just "exhaust on" and "exhaust off."

Knock-out Ventilation

Expressing particular interest in dust-extraction at the knock-out and the relative merits of down-, up- and side-draught, he said there seemed to be many schools of thought in that connection, but he was a believer in side draught. In his opinion a down-draught exhaust could not deal with the finest dust, which presented the greatest risk to health; the down-draught exhaust was masked by the moulding box while it was on the knock-out, and it released heat which tended to carry the dust upwards away from the knock-out again, whereas the side-draught would take the dust away with the minimum of obstruction and of discomfort to the operators. Up-draught was discomforting to the operators, because on the average-size knock-out they had to bend over, so that their faces were in

a rising cloud of dust. Again, down-draught was not only ineffective but it took away from the sand a lot of the constituents which had already fallen into the hopper and had subsequently to be replaced before the sand was re-used.

With regard to electrostatic precipitation, Mr. Gresty had rather stolen his thunder. The capital cost was high and a relatively large space was required for an installation to deal with an average volume of air. The method was used considerably in this country for particular purposes, but in foundries its cost was prohibitive in relation to the benefit derived from it—other methods would give equal efficiency at much lower cost. He did not think we should ever see electrostatic precipitators used extensively in foundries in this country.

MR. LAWRIE replied that the type of filter used in the K & L fettling bench was just a cotton-wool pad. They had been anxious first of all to find a system which would take the dust from the point of its generation into the extraction system. He had found himself at variance with many exhaust ventilation engineers in foundries, because he was always looking at the other end of the plant from that in which the engineer was interested. An engineer would say that a good dust-arrester was being used, whereas Mr. Lawrie was looking at the space between the point of generation and the exhaust hood, to see whether the dust was going into the exhaust system or was going the other way. The cotton-wool filters used had to be changed for each shift.

Exhausts from a Stand Grinder

As to the standard exhaust for the stand grinder, he had meant the sort of grinder we could buy with its normal fittings. It was a standard machine produced by a certain maker, and foundrymen put it in the shops as they bought it. The air-intake velocity was about 1,000 ft. per min., and the machine was double-ended.

As to whether a higher velocity would give better control and whether experiments had been made with varying rates of exhaust, he said investigators were just about to start work on the latter, and also on varying the wheels' peripheral speeds. There might be a critical peripheral speed above which trouble would occur. In that connection, he referred to a phenomenon witnessed where a worn wheel was used with a big hood, and two air-streams were visible. The dusty air came out at the wheel face and the exhaust was sucking in clean air over the top of the dusty stream. He had a feeling that increased inward velocity would merely compress the stream of outgoing air, but would never entirely reverse it.

Section 3 of the Factories Act provided that the foundry, or other works, must be heated, and Section 47 (as construed by some ventilating people, at any rate) seemed to require that all the air must be sucked out after it was heated. This would appear to make the two requirements quite incompatible. So that it seemed that the line along which the ventilating people should be thinking was to reduce the volume of air extracted, instead of increasing it. If in one works there was extraction at the rate of 2,000 cub. ft. per min., and in others the rates were 4,000, 6,000 or 8,000 cub. ft. per min., the foundryman would be less concerned with the cost of the exhausting system, than with buying a new boiler for heating the shops. Natural air movements should be used to do what it could in the way of extraction.

On re-circulation, he proposed to consider the matter entirely from the technical side. Not very long ago, he said, a dust-arrester was photographed under laboratory conditions; it was not a works arrester, but was built for the laboratory; it was not used much, and it was dusted most carefully each day by a charwoman, so that its condition was as new. The photograph obtained was rather like that of the safety valve of a steam boiler, except that it was blowing dust instead of steam. There was the dust-arrester, inside the building, properly vented through to the open air, but having a cloud of dust coming through its side into the room. In view of such a conception, he did not profess to know what "re-circulation" meant. As to the pedestal grinder, where the wheel was blowing clouds of dust at the operator, he wondered if this would be called recirculation. It was, he thought, evident that the primary question was one of providing better dust control.

MR. GRESTY, discussing side-, bottom- and top-exhausts for knock-outs, said knowledge was wanted as to which would really do the job. With that object in view, very shortly the whole of the foundry industry would be asked, probably through the media of the Bulletin of the Council of Ironfoundry Associations and FOUNDRY TRADE JOURNAL, to communicate with one or other of the committees if individuals considered they had something good in the knock-out line. It was proposed, when replies were received, to send a questionnaire to the foundries from which the replies were received, asking for more detailed data for purposes of comparison. It was further desired to review all the various methods and to send one or two teams of people around to test them.

A SPEAKER asked if the investigators had experience of the use of secondary air on the outside of the casing of a pedestal grinder, sucking in, and a small volume of air coming from behind the person working the grinder.

MR. LAWRIE said that had not been tried. Investigators were not at all keen on having air movement from behind the person working the grinder, because he might object. Had the speaker any information available?

THE SPEAKER said he had prepared such an arrangement and hoped to be able to try it out very shortly and agreed for Mr. Lawrie's investigators to conduct some tests on it.

MR. G. C. PIERCE, introducing what he called a "disturbing" note, referred to an earlier statement that foundries were very deeply concerned about the dust problem. He questioned if that was correct, and said he could provide plenty of evidence of foundries which were not half as worried as they

should be, and he regretted that that was so. He thought founders generally had done very little about dust and insufficient on the lines of the recommendations of the " Garrett " report.

MR. LAWRIE said of course, many foundries had not done all that they should have done, and some had done nothing about the dust problem. On the other hand, many had done a great deal more than might honestly have been expected of them, and tremendous effort had been put into the work of implementing the " Garrett " report. He was not speaking particularly of the provision of amenities such as shower-baths, and the like, although he knew conditions had been improved tremendously in that respect. The difficulty about work in connection with the dust problem was that we were as yet ignorant as to how to commence. There were many founders in this country whose efforts had been something of an embarrassment, because whenever he made a suggestion they had offered plant and equipment and told him that, if he thought he could do something beneficial, for Heaven's sake to come and try!

MR. PIERCE, having heard a suggestion that the fettlers should be shown the film, commented that if that were done the foundries would lose a lot of fettlers.

Appreciation of Operators

MR. LAWRIE assured him that the film *had* been shown to fettlers. It had been shown to the Institute in June, 1951, there were copies of it in America, Sweden, Italy, Canada and at the International Labour Office in Geneva; in this country during the last few months it had been exhibited at 18 or 19 meetings, and it had also been shown about 40 times to *ad hoc* groups of people who were interested. It was shown at the annual conference of the Amalgamated Union of Foundry Workers in Margate in 1951, and at the conference of the Confederation of Shipbuilding and Engineering Unions, as well as to other unions throughout the country. On the whole the workers were fairly reasonable people—as were foundry owners and the managers—and a number of them were very happy and grateful that somebody was trying to do something for them.

MR. T. C. HALE, a visitor, after expressing appreciation of the opportunity to see the film and to hear Mr. Lawrie's lecture, said that for 30 years he had been in the asbestos industry, where for the last 20 years they had been struggling against the horrible disease, asbestosis; they had had their successes and their failures, but conditions were very much better now than they were 20 years ago. Endorsing the remarks on the very serious nature of the problem, he said we certainly could not put things right by ill-considered methods. It was an engineering problem and must be tackled by engineers in the first place. The medical side followed fairly closely, but the approach by way of treatment by means of respirators would not get us anywhere. He considered many respirators were useless.

MR. LAWRIE agreed that the problem must be treated seriously, and it was so regarded. He expressed the hope that the speaker would give to the investigators any information possessed by the asbestos trade.

Vote of Thanks

MR. BARNARD, who proposed the thanks of the meeting to both Mr. Gresty and Mr. Lawrie, said it was obvious from the questions that many would take an increasing interest in the dust problem. He agreed that founders must apply systems other than the use of masks, and must really get down to the question of dust suppression.

MR. F. ARNOLD WILSON, seconding, said we still did not know a great deal about the problem of dust suppression, and it was most praiseworthy that such strenuous efforts were being made with regard to it. In a comment on the film, he suggested jocularly that it might have borne, at the beginning, the letter " X," which he believed was applied to all horrific films shown to the public.

(The vote of thanks was accorded with acclamation.)

The PRESIDENT, in a brief response, said although his part in the proceedings had been very small, he was intensely interested in the subject.

MR. LAWRIE, who also responded, paid tribute to Mr. Gresty for having been so very active in the attack on the problem over the last seven years. He urged that all present should consider the problems enumerated and communicate their suggestions and experiences to the investigators.

German Ore Imports

Imports of seaborne ore into Germany in the first two months of 1952 show a marked increase over imports in the same period last year. In January and February, 1952, 1,165,000 metric tons were imported, compared with 896,000 metric tons in January and February, 1951.

Total imports of seaborne iron and manganese ores in 1951 amounted to 7,935,000 metric tons, compared with 5,219,000 metric tons in 1950.

B.I.S.R.A. Projects

According to the April issue of " B.I.S.R.A. Survey," summary of work in progress by the British Iron and Steel Research Association, tungsten/molybdenum immersion thermocouples are being used to measure temperatures up to 1,850 deg C. for controlling steelmaking when oxygen-lancing raises temperatures above normal levels. Refractory problems were a hold-up, but alumina coated with alumina cement and preheated over the bath to 1,250 deg. C. may be the solution. A second note on arc-furnace electrodes states that poor electrode performance is often due to the specific resistance of the graphite being too high. Savings amounting to 2s. per ton of steel have been made by establishing an acceptance test for graphite electrodes.

Sampling

A symposium on " Sampling " is to be held at Clausthal-Zellerfeld, Germany, from April 23 to 25, organized by the Gesellschaft Deutscher Metallhütten- und Bergleute and the Verein Deutscher Eisenhüttenleute. All types of sampling problems will be discussed from metallic ores to iron, steel and non-ferrous products and scrap.

Steel Output Up in March

Steel output in March was at an annual rate of 16,648,000 tons, a slight increase over the figure for March, 1951, when production was at an annual rate of 16,546,000 tons. The figure for last year was, however, relatively low because of the Easter holiday. February output was at an annual rate of 16,281,000 tons. Pig-iron production reached the highest monthly rate yet achieved last month, the annual rate being 10,478,000 tons, compared with 10,263,000 tons in February and 9,572,000 tons in March, 1951.

Announcing these figures, the British Iron and Steel Federation pointed out that coke supplies were still inadequate to meet the needs of the blast furnaces. During March stock were drawn on at a rate of 2,000 tons a week. The total stocks on the ground and at blast furnaces now represent only four days' supply, which is less than a safe minimum. This compared, the Federation stated, with a programme figure of at least three weeks' stock held by other coke users.

Need for Larger Pig-iron Output

Further increases in pig-iron production are essential if steel production is to reach even the level of last year. The necessary expansion of pig-iron production will be assisted by three new blast furnaces which are due to come into operation during April and May at Skinningrove, Consett, and Cargo Fleet, and by an additional furnace at Kettering which is being brought into blast with the help of Italian labour.

After allowing for two old furnaces which will go out of operation, one at Skinningrove and one at Cargo Fleet, and an increased use of home ore generally, pig-iron production in the country would increase by a further 300,000 tons a year provided additional coke is available also at the rate of 300,000 tons a year. Arrangements to bring these furnaces into blast cannot be completed until at least 6,000 tons a week of additional coke is assured.

The steel industry's development plan is based on a supply of purchased coke from the National Coal Board and other ovens of 76,000 to 77,000 tons a week. This was the tonnage of purchased coke supplied in 1948, when the forward coke plans were made. At present, in spite of some increase in total N.C.B. coke output, deliveries of purchased coke (which constitute about a third of the industry's supply of coke) have fallen to an average of about 70,000 tons a week.

Unless this short-fall in purchased coke supplies can be overcome, pig-iron development will be held back and steel production will be below last year's level.

Latest steel and pig-iron output figures (in tons) compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1952—January ..	198,500	10,319,000	293,000	15,234,000
February ..	197,400	10,263,000	313,100	16,281,000
March ..	201,500	10,478,000	320,200	16,648,000
1st quarter ..	199,100	10,355,000	307,500	15,991,000
1951—January ..	183,100	9,520,000	305,900	15,907,000
February ..	186,300	9,687,000	326,000	16,952,000
March ..	184,100	9,572,000	318,200	16,546,000
1st quarter ..	184,400	9,587,000	315,900	16,425,000

A CARGO VESSEL of about 6,400 tons and costing more than £500,000, is to be built by Harland & Wolff, Limited, Glasgow, for the Port Line, Limited, London.

Iron and Steel Institute

Annual General Meeting Programme

The eighty-third annual general meeting of the Iron and Steel Institute will be held on Wednesday and Thursday, April 30 and May 1. The morning session on Wednesday, April 30, will take place in the theatre at the Royal Institution, Albemarle Street, London, W.1. The remainder of the meeting will be held at the offices of the Institute, 4, Grosvenor Gardens, London, S.W.1.

WEDNESDAY, APRIL 30

Morning Session: 9.45 a.m. to 1 p.m. (Royal Institution): Presentation of the Report of Council and statement of accounts for 1951; presentation of the Bessemer Medal for 1952 to Mr. H. H. Burton, C.B.E., the Sir Robert Hadfield Medal for 1952 to Dr. L. Reeve, and the Williams Prize for 1951 to Mr. J. A. Bond and Mr. T. Sanderson. Election of members, followed by induction of the new President, Capt. H. Leighton Davies, C.B.E., and presidential address. After an interval the Sixth Hatfield Memorial Lecture, on "Flow of Metals," will be presented by Prof. E. N. da C. Andrade, D.Sc., Ph.D., F.R.S.

1 to 2.30 p.m.: Buffet luncheon in the Joint Library, 4, Grosvenor Gardens, London, S.W.1. Buses will be available to take members from the Royal Institution to the offices of the Institute.

Afternoon Session: 2.30 to 4.45 p.m. (Offices of the Institute): Discussion on:—"Cold Rolling with Strip Tension. Part I: A New Approximate Method of Calculation and a Comparison with Other Methods," by H. Ford, F. Ellis and D. R. Bland; "Effect of Tension on Torque and Roll Force in Cold-strip Rolling," by W. C. F. Hessenberg and R. B. Sims; "Pressure Distribution between Stock and Rolls in Hot and Cold Flat Rolling," by C. L. Smith, F. H. Scott and W. Sylwestrowicz; "Softening of Metals during Cold Work," by N. H. Polakowski.

Members' dinner at Grosvenor House, Park Lane, W.1, 7 for 7.30 p.m.

THURSDAY, MAY 1

Morning Session: 10 a.m. to 1 p.m. (Offices of the Institute). Discussion on:—"An Experimental Furnace for the Investigation of Open-hearth Furnace Combustion Problems. Part V: Experiments with the Venturi Port and Modifications Thereof," by J. F. Allen. Part VI: "Summary of Results and Their Application in Practice," by J. R. Hall and A. H. Leckie. After an interval there will be a discussion on:—"Measurement of Air Infiltration in Open-hearth Furnaces," by R. Haynes; and "Aerodynamic Factors Associated with the Wear of Open-hearth Furnace Roofs," by J. A. Leys and E. T. Leigh.

Afternoon Session: 2.15 to 4 p.m.: Discussion on:—"The Determination of Hydrogen in Liquid Steel," by R. M. Cook and J. D. Hobson; "Diffusion of Hydrogen in Iron and Iron Alloys at Elevated Temperatures," by P. L. Chang and W. D. G. Bennett; "Distribution of Hydrogen in Large Ingots and Forgings," by J. D. Hobson and C. Sykes; and "The Effect of Hydrogen on the Properties of Low-alloy Steels," by J. D. Hobson and C. Sykes.

Institute of Metals Autumn Meeting

The autumn meeting of the Institute of Metals will be held in Oxford from September 15 to 19, inclusive. The Oxford local section is acting as reception committee. The meeting will be opened by the autumn lecture by Prof. H. W. Swift on plastic deformation of metals.

World Steel Production

During 1951, according to the February "Statistical Bulletin" of the British Iron and Steel Federation world steel production is estimated to have risen by 11 per cent., to 206 million tons, thus exceeding 200 million tons for the first time. Referring to the accompanying table, it will be seen that once again the United States showed the biggest absolute expansion of over 7 million tons, or 8 per cent.; even larger percentage increases, however, occurred in other major producing countries, notably the U.S.S.R., Western Germany, France, Japan, and Belgium, totalling 9 million tons. Of the 20 million tons increase in world steel production over 1950, these countries together thus accounted for more than 16 million tons. In the U.K., however, output declined by 0.65 million tons owing to the drastic curtailment of scrap imports.

In the table, estimates for the year 1951 have been made for many countries where the final figures are not yet available, those for Russia and Eastern Europe having been taken from E.C.E. sources. The total for the year is therefore provisional. It may be noted that world production last year was 72 million tons, or 54 per cent., above the peak pre-war output of 1937, output in the United States being nearly 9 per cent. higher because of the large reserve of idle capacity in existence pre-war, and the unhampered expansion of the war years. The U.S.S.R. and her Eastern European satellites produced 40 million tons of steel in 1951, compared with 56 million tons in the O.E.E.C. countries and 134 million tons in the N.A.T.O. Treaty countries, which include the U.S.A. and Canada.

World Output of Steel Ingots and Castings. (*Million Long Tons.*)

	1937.	1950.	1951.
U.S.A.	50.57	86.46	93.87
U.S.S.R.	17.54	27.16	30.80
U.K.	12.98	16.29	15.64*
W. Germany	15.37	11.93	13.29*
France	7.79	8.51	9.68
E. Europe†	6.45	8.02	9.09
Japan	5.71	4.76	6.39
Belgium	3.80	3.72	4.92
Canada	1.40	3.02	3.19
Luxembourg	2.47	2.41	3.03*
Italy	2.05	2.32	3.00*
Saar	2.30	1.87	2.56*
India	0.90	1.44	1.50
Sweden	1.09	1.42	1.48*
Finland, Yugoslavia, Spain	0.39	1.32	1.36
Australia‡	1.10	1.25	1.44
Austria	0.64	0.93	1.01
S. Africa	0.33	0.74	0.93*
Brazil	0.08	0.78	0.80
Netherlands	0.06	0.48	0.54
Mexico	0.02	0.22	0.30
Turkey	—	0.09	0.13
Norway	0.06	0.07	0.08
Other countries	0.55	0.42	0.62
Total ..	133.65	185.63	205.65

* Final figure.

† Czechoslovakia, East Germany, Hungary, Poland, Rumania, Bulgaria.

‡ Years ended June 30.

IMPORTS of seaborne ore into Germany in the first two months of 1952 show a marked increase over imports in the same period last year. In January and February, 1952, 1,165,000 metric tons were imported, compared with 896,000 metric tons in January and February, 1951. Total imports of seaborne iron and manganese ores in 1951 amounted to 7,935,000 metric tons, compared with 5,219,000 metric tons in 1950.

Sulphur Supply Prospects

The present world shortage of sulphur may become more acute. The economic and scientific factors surrounding the supply problems of this very important industrial raw material are discussed in "A Survey of the Sulphur and Sulphuric Acid Position," just published for the Department of Scientific and Industrial Research by H.M. Stationery Office (price 1s. 7½d., post free).

The United States is the chief source of sulphur, and last year exported some 900,000 tons, about half of which was for the United Kingdom. American sulphur comes from the domes in Texas and Louisiana. One recent estimate suggests that there is enough here for only 15 years at the present rate of mining. Sulphur occurs in other countries, but not in any great amount. In 1950, the United Kingdom imported only 357 tons from them, compared with 439,000 tons from the U.S.A. This is not only expensive in dollars; it means also that we are dependent on one source of supply.

There are other means of obtaining sulphur or sulphuric acid—from pyrites, for example. The largest reserve is in Spain and Portugal. Large deposits exist in the U.S.A. and Canada, but neither has been developed on any scale. The pyrites content of coal is another potentially important reserve. For instance, in the U.S.A. it is estimated that the amount of sulphur recoverable from known deposits of coal is about 3,000,000,000 tons. Present recovery is negligible. In this country the only important raw material for sulphuric acid is anhydrite. Extensive deposits occur at Billingham and in Cumberland. A new company has been formed to produce the acid, but it will be some years before the plant will come into operation.

The D.S.I.R. survey discusses this and other sources of sulphur. One of these is the flue gases of power stations. Some 300,000 to 400,000 tons of sulphur a year are burned with the 30,000,000 tons of coal consumed by power stations in this country. The Fuel Research Station of D.S.I.R. is looking into this problem and has erected a pilot plant for washing the gases. Blast-furnace slag is another potential source of sulphur estimated at 100,000 tons. The survey also gives details of many methods of conserving sulphuric acid, mainly in the fertilizer industry and in iron and steel pickling.

Trade of the Tees

Trade returns for the Tees for February show that imports totalled 239,290 tons, an increase of 39,762 tons over the corresponding period of last year. This was due in some measure to increased arrivals of iron ore (37,948 tons) and coal (9,442 tons).

Exports amounted to 114,655 tons, 4,230 tons more than the total for the previous month, increased shipments of manufactured iron and steel (7,436 tons) being partly responsible. Compared with February, 1951, decreases in both coastwise and foreign exports, totalling 37,337 tons, were recorded. The fall was due mainly to smaller shipments of coal (16,119 tons) and chemicals (15,455 tons).

Alloys Cost More

The Federation of Secondary Light Metal Smelters has announced that following the increases in the Ministry of Supply's prices for raw materials, its members find it necessary to increase the maximum selling prices of the undermentioned alloys from April 15, as follows:—

LM1 from £157 per ton to £163 per ton; LM2 £175 to £181; LM4 £163 to £169; LM6 £186 to £190; and deoxidizing sticks (85/90) £143 to £149.

Pig-iron and Steel Production

Statistical Summary of January Returns

The following particulars of pig-iron and steel produced in Great Britain have been extracted from the Statistical Bulletin for February, issued by the British Iron and Steel Federation. Table I summarizes activities during the previous six months; Table II gives the production of steel ingots and castings in January, Table III gives deliveries of finished steel, and Table IV the production of pig-iron and ferro-alloys in January. References applicable are given at the foot of column 2.)

TABLE I.—*General Summary of Pig-iron and Steel Production.* (*Weekly Average in Thousands of Tons.*)

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			
						Imports.[2]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[3]
1950	249	174	197	185	197	9	313	239	997
1951	282	170	206	186	175	8	301	241	589
1951—August[1]	280	176	203	181	147	8	266	190	713
September ..	303	184	207	190	175	10	303	253	659
October[1]	278	180	210	190	174	11	301	243	595
November	280	192	215	196	182	13	316	250	568
December	278	189	216	198	159	10	288	232‡	589
1952—January[1]	293	190	222	199	164	13	293	238	538

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in January*, 1952. (*Thousands of Tons.*)

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	3.0	11.3 (basic)	1.6	0.2	15.3	0.8	16.1
Lancs. (excl. N.W. Coast), Denbigh, Flints, and Cheshire	1.6	19.3	—	1.9	0.6	22.2	1.2	23.4
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	27.8	—	—	0.2	27.8	0.2	28.0
North-East Coast	1.5	55.7	—	1.1	0.5	57.0	1.8	58.8
Scotland	3.4	26.8	—	1.3	0.7	30.4	1.8	32.2
Staffs., Shrops., Worcs. and Warwick	—	15.5	—	0.8	0.8	15.5	1.6	17.1
South Wales and Monmouthshire	8.0	52.8	5.3 (basic)	1.1	0.1	66.8	0.5	67.3
Sheffield (incl. small quantity in Manchester) ..	9.3	25.5	—	9.0	0.6	42.2	2.2	44.4
North-West Coast	0.5	1.4	3.3 (acid)	0.4	0.1	5.6	0.1	5.7
Total	24.3	227.8	19.9	17.2	3.8	282.8	10.2	293.0[1]
December, 1951	23.2	223.4	22.1	15.5	3.4	278.1	9.5	287.6
January, 1951[1]	25.6	241.0	20.8	15.2	3.3	297.4	8.5	305.9

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel.* (*Thousands of Tons.*)

Product.	1950.	1951.	1951.		1952.
			Jan.[1]	Dec.	Jan.[1]
Non-alloy steel:					
Ingots, blooms, etc.[4] ..	3.6	4.0	3.8	4.1	3.9
Heavy rails, sleepers, etc.	11.3	10.1	8.9	9.3	9.4
Plates ⅛ in. and over ..	40.0	41.0	38.7	41.4	39.0
Other heavy prod.	40.2	39.9	40.9	35.9	37.8
Light rolled prod.	47.6	47.1	49.0	43.8	46.4
Hot-rolled strip ..	19.4	19.5	18.9	17.5	18.0
Wire rods	16.3	16.1	17.5	12.6	15.8
Cold-rolled strip ..	5.5	6.0	5.9	5.9	6.4
Bright steel bars ..	6.3	6.6	7.1	5.5	7.0
Sheets, coated and uncoated ..	30.5	33.5	31.4	32.5	34.9
Tin, terne and blackplate ..	14.3	13.9	14.1	13.2	15.4
Tubes, pipes and fittings	20.0	22.0	19.6	23.5	21.6
Mild wire	12.5	11.9	12.2	10.5	11.6
Hard wire	3.5	3.7	3.8	3.4	3.5
Tyres, wheels and axles	3.5	3.7	3.5	3.4	3.6
Steel forgings (excl. drop forgings) ..	2.2	2.3	2.0	2.4	2.2
Steel castings ..	3.5	3.8	3.6	5.5	4.1
Total	280.2	285.1	280.9	270.4	280.6
Alloy steel	10.6	12.3	10.7	13.6	11.8
Total deliveries from U.K. prod.[5] ..	290.8	297.4	291.6	284.0	292.4
Add: Imported	3.8	4.9	3.2	8.1	9.0
	294.6	302.3	294.8	292.1	301.4
Deduct: Intra-industry conversions[6] ..	55.6	61.5	59.1	60.3	63.8
Total net deliveries ..	239.0	240.8	235.7	231.8	237.6

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys during January*, 1952. (*Thousands of Tons.*)

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	25	—	17.9	24.8	1.5	—	44.2
Lancs. (excl. N.W. Coast), Denbigh, Flints, and Cheshire ..	6	—	8.0	—	—	0.7	8.7
Yorkshire (incl. Sheffield, excl. N.E. Coast) ..							
Lincolnshire ..	13	—	27.2	0.3	—	—	27.5
North-East Coast	24	7.2	38.6	0.1	—	1.4	47.3
Scotland ..	9	0.8	12.2	2.9	—	—	15.9
Staffs., Shrops., Worcs., and Warwick ..	9	—	8.6	1.6	—	—	10.2
S. Wales and Monmouthshire	8	3.2	25.0	—	—	—	28.2
North-West Coast	8	15.2	—	0.2	—	1.0	16.4
Total ..	102	26.4	137.5	29.9	1.5	3.1	198.4[1]
December, 1951	102	26.9	137.9	28.6	1.1	3.2	197.7
January, 1951[1] ..	101	25.7	126.6	26.7	1.4	2.7	183.1

[1] Five weeks.

[2] Weekly average of calendar month.

[3] Stocks at the end of the years and months shown.

[4] Other than for conversion into any form of finished steel listed above.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] Material for conversion into other products also listed in this table.

Personal

MR. J. CURTIS, manager of the spun plant department at the Stanton Ironworks Company, Limited, near Ilkeston, has retired.

MR. J. C. SHANKS, who has been manager of the Scottish area of the Sunderland Forge & Engineering Company, Limited, for many years, has been appointed a local director of the company.

MR. J. F. PECK, head of the mechanical and civil engineering department of the College, Loughborough, has been awarded the Ludwig Mond prize by the Council of the Institute of Mechanical Engineers.

MR. G. I. OGLEY, headquarters accountant, has retired after 52 years' service with Newton Chambers & Company, Limited, at their Thorncliffe Works, Chapeltown. He was presented with two fireside chairs, by Sir Harold West, managing director.

MR. H. C. BUTCHER, who held the position of secretary at Samuel Fox & Company, Limited, Stocksbridge, has retired after 52 years' service with the Company. He will be succeeded by MR. F. STONES, who has been with the United Steel Companies, Limited, for 26 years.

MR. S. F. SMITH, head of the electronic instruments department of Philips Electrical, Limited, has recently been awarded the Bessemer Premium by the Society of Engineers for his paper entitled " Electronic Instrumentation as applied to the Study of Vibrations in Industry."

A WELCOME VISITOR to this country is MR. R. H. SCHAEFER, vice-president in charge of research and development of the American Brake Shoe Company. He is accompanied by his wife and is staying at the Savoy Hotel, London, W.C.2. He evidently has a full-time job, as no fewer than forty plants are under his supervision. We hope our readers will accord him every courtesy during his stay in this country.

SIR WILLIAM WALLACE, chairman and managing director of Brown Bros. & Company, Limited, Edinburgh, has been appointed president of the Institution of Engineering & Shipbuilders in Scotland as from October 1. He succeeds SIR ANDREW MCCANCE, deputy chairman and joint managing director of Colvilles, Limited. MR. JOHN BROWN (John Brown & Company, Limited, Clydebank) and MR. A. R. MITCHELL (Yarrow & Company, Limited, Glasgow) have been appointed vice-presidents.

MR. C. D. GRAHAM has joined the staff of the Chance Technical College, Smethwick, as head of the engineering department, coming there from the Merchant Venturers College at Bristol. Under the principalship of Mr. F. W. Cooper, who succeeded Mr. H. Garratt as head of the College recently, Mr. Graham will be responsible for the technical education in engineering of the apprentices who attend the College from many of the large firms in the area, including Birmid Industries, Limited.

MR. D. REDFERN, who has been foundry manager with G. M. Hay & Company, Limited, Glasgow, for the past five years, has resigned his appointment as from March 28, to take up a new position as foundry manager with Carmichael Bros., Limited, South Shields. His departure from Hay's foundry was marked by a pleasant incident, when the workmen and staff gathered to wish him success and happiness in his new post, and the opportunity was taken to make a presentation to him as a memento of the years they had worked together.

LORD MATHERS, who was given a peerage on his resignation last year as M.P. for West Lothian, was the principal personality at an interesting presentation ceremony on April 1 at the works of Smith & Wellstood, Limited, Bonnybridge. On behalf of H.M. the Queen, Lord Mathers presented JAMES LENNIE, a fitter with the firm, with the B.E.M. in recognition of his services on the production side of the firm's activities, and also for his work as a member of St. Andrew's Ambulance Corps. Announcement of the award was made in the King's New Year's Honours List.

MR. WILLIAM MCCORKINDALE, who claimed £5,000 damages from the Lion Foundry Company, Limited, Kirkintilloch, because he contracted pneumoconiosis while in their employ, has been awarded £2,300 by Lord Mackintosh in the Court of Session. McCorkindale, who worked for the firm for 32 years, was employed for six years as a sand-blaster, and he alleged that the Company did not keep the sand-blasting plant in a safe condition. They allowed it to become leaky at several points, and metallic and siliceous dust frequently and regularly escaped from it into the atmosphere.

MR. JAMES SUTTIE, of Chicago, who left Edinburgh in 1911 after being employed at the Castle Mills, has been chosen as recipient of the Lorentz Memorial Medal for 1951, the highest award in the gift of the Steel Founders' Association of America. The citation states that the award had been given for Mr. Suttie's " unselfish interest and devoted support of practically every activity of the Steel Founders' Association for many years . . . his patience and understanding in both an official and unofficial capacity as an 'ambassador of goodwill'." Mr. Suttie is now vice-president of American Steel Founders, Chicago.

Obituary

MR. CHARLES CLEAVER

We regret to announce the death, on April 9, of Mr. Charles Cleaver, co-founder and director of Kelly & Cleaver, Limited, 237, Walworth Road, London, S.E.27. He was 68 years of age, and was of a modest and retiring disposition. At one time, he was foundry clerk to the Aston Construction Company, Limited, and when, in 1936, that firm decided to close down its foundry, Mr. Cleaver with Mr. Kelly went into business on their own account. The late Mr. Kelly, a thoroughly practical foundryman, could not read or write, but these drawbacks was minimized through Mr. Cleaver's sympathetic assistance. The business prospered and is now carried on by a second generation. Mr. Cleaver joined the Institute of British Foundrymen in 1917, and for many years served on the Council of the London branch, and on numerous occasions refused the presidency. He did, however, for many years serve as honorary auditor. He was also an active member of the South of England Ironfounders' Association. The funeral was at Putney Vale Crematorium last Tuesday.

MR. JAMES RODGER, formerly managing director of the Glasgow firm of valve makers, Cockburns, Limited, died on Easter Sunday at the age of 75. He retired from the position of managing director three years ago, but continued as an active member of the Board until his death. He spent the early part of his life in California and in 1906, after his return to Glasgow, joined his father-in-law, the late Robert Cockburn, in the family business of Cockburns, Limited, becoming a director the same year. He was a member of the Institution of Engineering and Shipbuilders in Scotland.

News in Brief

ALL APPRENTICES at the Stanton Ironworks Company, Limited, near Ilkeston, are being given first-aid instruction as part of their training.

NEW DEVELOPMENTS in two phases of metallurgy will be reviewed in special courses on surface reactions in flotation and on the chemistry and mechanics of moulding materials to be given at the Massachusetts Institute of Technology during this summer.

ACHEMA X.—The International Exhibition of chemical engineering is to be held in Frankfurt on Maine, Germany, from May 18 to 25. Details may be obtained by writing to Achema at 25, Rheingau Allee, Frankfurt on Main.

THE BIGGEST SHIP ordered on the River Wear is to be built by Joseph L. Thompson & Sons, Limited, Sunderland. A tanker of 26,450 tons dw. for St. Helen's Shipping Company, Limited, London, the vessel will be engined by Wm. Doxford & Sons, Limited, Sunderland.

MR. J. B. MCINTYRE has pointed out that the one-piece cup, saucer and spoon casting, which was presented recently to Mr. F. Bray at the diploma award function of the National Foundry College, was made by the students in nickel-aluminium-bronze and subsequently polished.

AT THE ANNUAL GENERAL MEETING of the Pig-iron Merchants Association, held on April 8, Mr. F. Arnold Wilson of William Jacks & Company, Limited, Mr. Arnold Carr of Thos. W. Ward Limited, and Mr. Claude A. Parson of Parson Limited, were elected chairman, vice-chairman and treasurer respectively.

SPEAKING at a dinner in Glasgow recently Mr. C. A. Davy, Renfrew director of Babcock & Wilcox, Limited, told members of the firm's graduates' and students' association there was still ample room for entrants to the overseas staff. There were about 100 graduates and students present including representatives from France, India, Mexico, and Australia.

THE SEVENTY-FIRST ANNUAL MEETING of the Society of Chemical Industry, Aberdeen, will be held on July 7 to 12, the headquarters being in Marischal College, Broad Street, Aberdeen. On Wednesday the Messel Medal will be presented to Sir Henry Tizard, G.C.B., D.Sc., F.R.S., followed by the medallist's address, "The Strategy of Science." There is a full programme of works visits and social events.

AN INQUIRY has been received from Industrial Electricas Hess May & Company, Limited, Casilla 156-D, Santiago, Chile, importers and distributors of electrical appliances, etc., which is anxious to receive quotations from U.K. manufacturers for the supply of electric motors. Interested firms should write to the company direct at the above address, at the same time notifying the Board of Trade, Commercial Relations and Exports Department, Horse Guards Avenue, London, S.W.1 (reference, CRE/12396/52), of any action taken.

IT WAS "OPEN HOUSE" last week at Singer's sewing-machine factory, at Clydebank. Singer's are the largest employers of labour in Scotland with 12,000 workers on the payroll. The idea was to show women just how their husbands spent their working hours in the foundry, cabinet shop, painting section, or any of the other 56 departments in the factory. Following the visit there was a film show including illustrations of the sewing-machine's place in modern industry and shots of the Company's annual sports meeting, and finally tea was served.

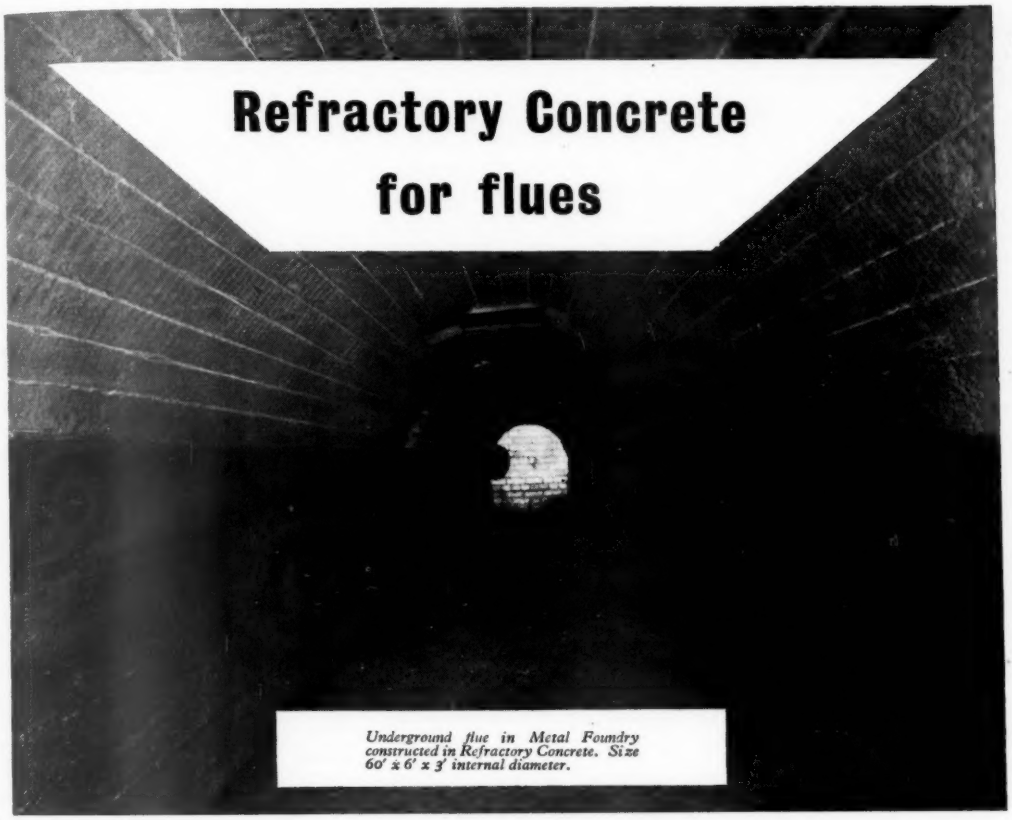
WORK on the John Deere factory, which will manufacture agricultural machinery, will proceed at the new town of East Kilbride, near Glasgow, at an early date, it is officially stated by the Earl of Home, on behalf of the Secretary of State, in a letter to Sir Patrick Dollan, chairman of East Kilbride Development Corporation. Sir Patrick asked for an immediate starting date so that representatives of the firm could proceed with their plans. It is estimated the factory will employ 2,500 at a minimum, and should be ready for production by the autumn of 1953.

AT FALKIRK, centre of the light castings industry in Scotland, nearly 400 men employed in the industry have been told that they are to work only four, instead of five days a week. They are principally employed in the production of baths, cookers, and stoves, some of them specially designed for export. The majority of the "short time" men are employed in the production of baths, at one large works in Falkirk which had no alternative orders to which to turn. Other firms can concentrate on other export and home market orders. Less than 30 men had to look for other employment.

DR. C. J. SMITHELLS, president of the Institute of Metals and of the Institution of Metallurgists, paid tribute to the Birmingham Metallurgical Society for its lead in providing a means of exchanging ideas in the metals industry, when he spoke at the Society's annual dinner on April 9. He added that such an exchange has had an enormous effect on the industry's progress, but he urged contributors of papers to scientific journals to keep articles short as an economy measure. Mr. H. W. G. Hignett, president of the Birmingham Society, presented the Society's medal and a cheque to Mr. T. M. B. Massalski, a 25-yr.-old student at Birmingham University, who had won first prize in the Society's essay competition.

SPEAKING at the annual dinner of the Birmingham and West Midlands branch of the Institute of Directors in Birmingham on April 3, Mr. Guy Chantrey, chairman, appealed for unity in order to give strength to the Institute. The total membership at present was, he said, just over 6,000, but the potential was very much higher. Directors, Mr. Chantrey went on, were the real leaders of industry who should be the dominating influence, as they might be if the membership could reach 20,000. The Institute had a great part to play in the rehabilitation of the country's economy and, as the "trade union of the bosses," members must convince the trade unions of employees that the policy of restrictive practices does not, in the long run, mean full employment but, on the contrary, less employment and a fall in the standard of living.

GLASGOW CHAMBER OF COMMERCE are to ask the chairman of South-West Scotland Electricity Board to explain the necessity for the threatened increases in tariffs and to justify the high cost of administration since nationalization. Explanations of these and many more points are called for in a letter drafted by a special committee, which was approved at a meeting of directors of Glasgow Chamber of Commerce last Monday. The committee met on March 25—shortly after Mr. William Hutton, deputy chairman of the Electricity Board had announced that increased charges—up to 25 per cent. in some cases—would probably come into force in June in Glasgow and the area covered by the South-West Scotland Electricity Board. After a long discussion, during which the attention of members was drawn to letters to the local newspapers protesting against the new charges, it was agreed that representations should be made to the Electricity Board.



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Raw Material Markets

Iron and Steel

Accepting as inevitable, and in the short run irremediable, the shrinkage in the supply of scrap, the steelmakers are concentrating primarily upon the rapid expansion of the output of pig-iron for the melting shops. Three new blast furnaces—at Cargo Fleet, Skinningrove, and Consett—are due to come into operation either this month or next, and at Kettering an additional blast furnace is about to be started with the help of Italian labour. The two new furnaces in the Cleveland area will replace two older stacks which are to go out of operation, but the net addition to productive capacity will be in the region of 300,000 tons per annum. All these plans, however, are contingent upon the supply of an additional 6,000 tons of extra coke from the NCB and other ovens. Moreover, the bulk of the increased pig-iron production, if it eventuates, will go to the steel plants, and it looks as though a much longer period will elapse before the pressing needs of the foundries are overtaken. There is a big demand for iron castings, but foundry operations are restricted by the scarcity of all grades of pig iron.

During the past two or three weeks, a few welcome consignments of Continental steel semis have arrived and have been promptly shared out around the re-rollers. Other shipments of American ingots now on the way may be rolled down into billets, of which the re-rollers still stand in urgent need. The position, in fact, is still very difficult. Sheet bars and slabs cannot be provided by British steelmakers in sufficient quantities to cover fully the requirements of the sheet mills, whose inability to achieve maximum production at a time of overwhelming demand is most inopportune.

Comparison of British steel prices with those of the principle producers oversea are definitely in favour of the former, and moreover, latest advices from Germany hint at a probable increase in German steel prices by about £5 per ton. Thus, if trade with the Dominions has been curtailed there are still abundant opportunities for marketing abroad, and as the spring advances the tempo of the export trade is quickening. Home demand, of course, is overwhelming and it is only held in check by the rationing system. Shipbuilders still complain of reduced deliveries of plates and in general the control is directing as much material as possible to users whose end products are for oversea destinations.

Non-ferrous Metals

The tin market closed last week on Thursday at midday and reopened on Tuesday morning. Business has not been very brisk on either side of the holiday. A contango is maintained on the market. Last week ended with something of a flourish, for quotations on Thursday showed gains of £4 10s. in cash, £5 5s. in forward, and of £6 in the settlement price, which on the previous day was listed at £961. The turnover on Thursday last was 85 tons.

No further news is to hand regarding the projected contract between the Bolivian producers and the United States Government. It seems as if the Bolivians will be obliged to say goodbye to their ideas of a price anywhere near $1.50, which was their original choice. There was a time when $1.25 might have been possible, but now that the Reconstruction Finance Corporation has succeeded in arranging for a considerable tonnage to be supplied at $1.18, the chances of any seller receiving more than this is rather remote. The most recent report from Washington suggests that some news of the negotiations will be available soon and that a settlement in the near future is not unlikely.

London Metal Exchange official tin quotations were as follow:—

Cash—April 9, £961 to £961 10s.; April 10, £966 10s. to £967; April 15, £962 10s. to £963 10s.; April 16, £961 10s. to £962 10s.

Three Months—April 9, £963 to £964; April 10, £969 10s. to £970; April 15, £966 to £966 10s.; April 16, £964 10s. to £965.

Considerable apprehension was felt when it became known last week that a strike on the Rhodesian copper belt seemed inevitable. Trouble had been brewing there for some weeks, and matters apparently came to a head before the Easter holiday. However, it was announced last Saturday that the strike had been called off, and doubtless Ministry of Materials officials and all concerned with the fabrication of copper and brass were greatly relieved, for the UK is largely dependent upon copper from Northern Rhodesia for maintaining activity. Apart from deliveries from the copper belt in the form of electro, the Ministry has conversion contracts which provide for the return of electrolytic copper against blister. Later this year it is anticipated that Rhodesia's output of electro quality will be increased as additional plant gets into operation.

The lead position continues to be favourable, and stocks are probably still rising. Zinc, too, is fairly plentiful, and it is likely that the trade is not taking up 100 per cent. of the allocations made by the Ministry.

Magnesium Advisory Committee

Essex Aero, Limited, wish to make it quite clear that they were not in any way concerned in the recent formation of a Magnesium Advisory Committee said to have been set up by the principal companies of the magnesium industry (JOURNAL, March 6). As Ministry of Supply returns show, this company was responsible during the period January 1, 1950, to December 31, 1951, for an output of 1,439 tons of rolled sheet and strip magnesium (some of which has been exported to the U.S.A.) of the total overall U.K. output of 1,487 tons, added to which there is a large annual output of cast products from the company's foundry. The company therefore considers itself to be a major producer. The company was asked to participate in this enterprise, but felt bound in the interests of the industry as a whole to preserve its complete independence.

In the use of the words . . . "The principal companies in the U.K. magnesium industry have formed a consultative and advisory body to be known as the Magnesium Advisory Committee" . . . the statement is not strictly accurate, with similar remarks applying to . . . "and to serve as the official liaison body for negotiations with the Ministry of Supply, Ministry of Materials and other Government departments on all related subjects" . . . and as producers of approximately 97 per cent. of the total output of rolled and strip magnesium in the United Kingdom, we are bound to point this out.

ORDERS HAVE BEEN RECEIVED by C. A. Parsons & Company, Limited, Newcastle-upon-Tyne, from the British Electricity Authority for a 60,000 kW. turbo-generator set, feed heating and condensing plant for Littlebrook "C" power station, Bradford, and for two 30,000 kW. turbo-generator sets, feed heating and condensing plants for Connah's Quay power station, near Flint. A. Reyrolle & Company, Limited, Hebburn, has received from the B.E.A. a contract for switchgear equipment for Elstree sub-station.